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THESIS

THE PRIMARY DIMENSIONS OF FINANCIAL CONDITION FOR FIRMS WITHIN THE DEFENSE INDUSTRY

by

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December, 1994

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19950608 067

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE December 1994	3. REPORT TYPE AND DATES COVERED Master's Thesis

4. TITLE AND SUBTITLE THE PRIMARY DIMENSIONS OF FINANCIAL CONDITION FOR FIRMS WITHIN THE DEFENSE INDUSTRY	5. FUNDING NUMBERS
6. AUTHOR(S) Robert M. White	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.	12b. DISTRIBUTION CODE

13. ABSTRACT *(maximum 200 words)*

This thesis examines the primary dimensions of financial condition for firms within the defense industry. Specifically, the thesis conducts a factor analysis of thirty-two financial ratios for 50 defense firms over a ten year period from 1983 through 1992 to identify the primary dimension of financial condition in the industry. Furthermore, the thesis examines whether these dimensions are represented by a specific subset of financial ratios and whether these primary dimensions and representative ratios are stable across time. The thesis concludes that there are nine primary dimensions of financial condition for firms within the defense industry. These dimensions are essentially stable across time. Furthermore, the subset of individual ratios which best describe the dimensions are also stable across time.

14. SUBJECT TERMS Defense Industry, Primary Dimensions of Financial Condition, Financial Ratios, Factor Analysis	15. NUMBER OF PAGES 80
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18 298-102

THE PRIMARY DIMENSIONS OF FINANCIAL CONDITION FOR FIRMS WITHIN THE DEFENSE INDUSTRY

by

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Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
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iii

ABSTRACT

This thesis examines the primary dimensions of financial condition for firms within the defense industry. Specifically, the thesis conducts a factor analysis of thirty-two financial ratios for 50 defense firms over a ten year period from 1983 through 1992 to identify the primary dimension of financial condition in the industry. Furthermore, the thesis examines whether these dimensions are represented by a specific subset of financial ratios and whether these primary dimensions and representative ratios are stable across time. The thesis concludes that there are nine primary dimensions of financial condition for firms within the defense industry. These dimensions are essentially stable across time. Furthermore, the subset of individual ratios which best describe the dimensions are also stable across time.

TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND

The early 1980s ushered in the resurgence of American military power. This resurgence was primarily due to the efforts of then President Ronald Reagan. Perhaps the most visible beneficiary of that administration's focus on expanding our military capability was the U.S. Defense Industry which realized significant revenues at the height of the buildup. The emotional fuel to support such an extensive military buildup in a period of ostensible peace was the specter of a more powerful, ruthless Soviet Empire. Additionally, this buildup came on the crest of strong economic growth in the mid-1980s. It appeared as though supply-side economics coupled with tax cuts was the answer to the stagflation of the 1970s.

Unfortunately, the early 1990s saw what many felt was the economic backlash of the Reagan era. The United States experienced a nation-wide recession. Meanwhile, our erstwhile enemies experienced radically worse economic duress ultimately culminating in the collapse of communism in all of Eastern Europe and the breakup of the former Soviet Union. This breakup brought about political clamoring for a "peace dividend." There was a wholesale political assault on the military budget and a drawdown which adversely impacted our defense industry. Finally, we began to see (and continue to see) a restructuring of U.S. industry and the expansion of the global economy.

All of these factors, in conjunction, provide the background for the current condition of the U.S. Defense Industry.

B. OBJECTIVES AND RESEARCH QUESTIONS

The broad objective of this thesis is to examine and analyze financial ratios patterns exhibited by defense industry corporations from the early 1980s through the early 1990s. In particular, this thesis examines the primary dimensions of financial condition throughout the study period. Related objectives include determination of a subset of representative ratios in the industry and whether or not these representative ratios remain so over the study period.

The thesis is intended to answer the following primary and secondary questions:

1. Primary Question

What are the primary dimensions of financial condition for firms within the defense industry?

When this thesis refers to the "primary dimensions of financial condition," the term is meant to be applied in a quantitative rather than qualitative sense. The primary dimensions are neither positive nor negative. They are those factors that most describe the industry.

2. Secondary Questions

1. Which individual ratios are most representative of the primary dimensions of financial condition within the industry?

2. What subset of ratios most effectively captures the full range of those financial dimensions?

3. Are the dimensions of financial condition stable across time?

4. Are the ratios that are most representative of each dimension consistent across time?

5. To what degree are different aspects of financial condition correlated?

6. How are the identified major dimensions and representative ratios related to economic growth and decline?

C. METHODOLOGY

The study was conducted in six steps:

1. Review of the pertinent literature.

2. Identification of the appropriate sample.

3. Collection of data and input onto a computer database.

4. Selection and calculation of financial ratios.

5. Factor analysis using the mainframe computer.

6. Preparation of this written thesis documenting the findings.

The fifty firms used in the study are a representative sample from the 100 Department of Defense contractors listed in the Defense 93 Almanac. [Ref.7] The emphasis was on larger firms, with a mix from various subindustries within the defense industry, such as automotive, shipbuilding, aerospace and electronics. The data was collected from annual reports and Moody's Industrial Manuals over the last ten years, focusing on information contained in balance sheets, income statements and statements of cash flow. The factor analysis procedure is a computer-based tool for statistically determining common dimension or factors underlying a set of multiple measures.

D. SCOPE, LIMITATIONS AND ASSUMPTIONS

The main thrust of the study is the statistical analysis of the financial data published by the sample corporations over the past ten years. Specifically, the thesis seeks to isolate the fundamental dimensions of financial condition within the defense industry and identify the financial ratios most representative of those dimensions. However, this thesis is not a firm-by-firm analysis or an attempt to measure the current financial health of the industry. Furthermore, there

is no attempt to assess the effect of the drawdown on the industry or the overall economy. The focus is on ratio patterns within the industry, not on the condition of the industry or specific firms. These ratio patterns will hopefully inform the reader as to which of the numerous possible ratios that may be calculated will best describe the industry.

E. LITERATURE REVIEW

The most pertinent area of literature relevant to the thesis studies the underlying dimensions of financial condition reflected by specific individual financial ratios. Studies on the dimensions of financial condition are concerned with the interrelationships and correlations among individual ratios. Since there are literally hundreds of ratios that can be constructed from financial information, one objective of the literature has been to determine a small set of ratios that best reflect the dimensions of financial condition.

Prior research has laid the foundations for exploring the thesis questions. In a seminal study, Pinches, Mingo and Caruthers (1973) identified seven common dimensions of financial condition for a sample of industrial firms and found evidence that the dimensions were relatively stable across time. [Ref.5,p.390] Other studies have similarly attempted to identify primary financial data with similar results. It is appropriate to use this prior research as a guide and apply its methodology to this study of the defense industry.

F. ORGANIZATION OF STUDY

Chapter II contains a more detailed interpretation of the literature referred to in the previous section. It will discuss the questions investigated by prior studies, the approaches used to investigate those questions and the findings that resulted. Chapter III contains a discussion of

the research methodology and data collection techniques as well as a detailed explanation of the factor analysis procedures applied to the sample. Chapter IV explains the results of the statistical analysis and answers the research questions outlined in Section B above. Chapter V will conclude the thesis with a summary and recommendations for further study.

II. LITERATURE REVIEW

A. OVERVIEW

Financial ratios are the basis and foundation for innumerable decisions in the world of business. From a strategic standpoint a manager couldn't hope to plan effectively if there weren't reliable output data from which to draw conclusions. Over the years, financial ratios have proven to be extremely important in this regard. Of course, these ratios have no face value. Financial ratios must be compared and contrasted against similar ratios. These ratios are typically compared against those of competitors, the respective industry averages or past ratios values. In short, "financial ratios have played an important part in evaluating the performance and financial condition of an entity." [Ref.4,p.51] Since there are literally hundreds of ratios that can be constructed from financial information, one of the objectives of prior research has been to determine a smaller set of ratios. This research has laid the groundwork for exploring the previously described thesis questions. There have been four major studies investigating this question which this thesis uses as a guide. These studies have concentrated on U.S. firms as a sample. However, none of the prior research has concentrated specifically on the U.S. Defense Industry.

B. QUESTIONS INVESTIGATED

The main question investigated in the studies has been which ratios are the most representative of all ratios chosen for evaluation. Other questions investigated by these studies include analyses of both the short-term [Ref.6,p.296] and long-term stability of the ratios most representative over time. Overall, these studies are "interested in the development of empirically based classifications (or

7

taxonomies) of financial ratios." [Ref.5,p.389]   "It is impossible to include most of the useful ratios found in the literature. Which ratios, then should be deleted and which should be included"? [Ref.4,p.51]   In all of the examined literature on the subject, the questions investigated were basically the same. In essence, they are the same questions this thesis is designed to answer on a different data set.

C.   APPROACHES

In their book entitled A Cross-Industry Analysis of Financial Ratios, Ketz, Doogar, and Jensen [Ref.1] examines a sample of 476 companies over the ten-year period from 1978 to 1987.   They divided there sample into seven industries defining an industry as a set of 32 or more companies in the same type of business. [Ref.1, p.5]   This study employed 32 ratios. (As Chapter III will document, these same 32 ratios are used in the methodology in the current thesis).   The methodology employed by the aforementioned authors is factor analysis. Specifically, "taxonomies or classification schemes are developed via a statistical technique called *factor analysis*." They performed this analysis for each industry and the whole sample of 476 for each of the ten years.   In general, the approach for all the studies which "focused on the development of a taxonomy of financial ratios" [Ref.1,p.17] have used primarily the same approach with slight variations.

> Pinches, Mingo, and Caruthers [1973] conducted the first classification study. They used factor analysis to examine the relationships among 48 financial ratios on a sample of 221 manufacturing corporations. This process was carried out for the years 1951, 1957, 1963, and 1969. Pinches et al. found seven financial ratio groupings: Return on Investment, Capital Intensiveness, Inventory Intensiveness, Financial Leverage, Receivable Intensiveness, Short-term Liquidity, and Cash Position. This taxonomy was appropriate for all

four years studied. The research was replicated in Pinches Eubank, Mingo, and Caruthers [1975]. In that paper, they examined data over the 1961 to 1969 time period. Results were essentially the same as in the first paper.

Chen and Shimerda [1981] broadened the use of taxonomic analysis by collating the ratios across a variety of studies, especially those concerned with predictions of business failure. They wanted to assess whether differences across studies were due to the variables or some other influence. Chen and Shimerda factor-analyzed the list of financial ratios and concluded that differences across studies are primarily in nomenclature rather than in the patterns themselves. Thus, Chen and Shimerda showed that the results of Pinches et al. [1973] and Pinches et al. [1975] could be reconciled to the results of other empirical studies. [Ref. 1, p.18]

D. METHODS

The Ketz et al. study used factor analysis to reduce the 32 ratios down to seven factors using the varimax rotation procedure. Since this thesis uses the same procedure, an explanation of varimax rotation will be provided in the methodology chapter. The Pinches et al. study used both rotated and unrotated factor patterns and both orthogonal and oblique rotations. Orthogonal and oblique refer to two different ways to rotate the data for analysis. Rotations are used "to increase the interpretability of the factors." [Ref.1,p.32] Orthogonal rotations keep the factors uncorrelated while oblique rotations allow for correlation.

In The Hierarchical Classification of Financial Ratios [Ref.6], Pinches, Eubank, Mingo, and Caruthers specifically employ oblique factor analysis techniques "to determine the first-order groupings (or factors) of the financial ratios based upon their empirical similarities." [Ref.6,p.298] Chen and Shimerda performed some analyses using principal component analysis of 39 ratios for as many as 1053 firms. Finally, one of the most effective methods to find the ratios most

9

representative of financial condition of an industry is to conduct factor analysis of a sufficiently large data set using an appropriate set of ratios.

E. FINDINGS

In keeping with the format of the previous sections of this literature review, a review of the findings of all four studies will be discussed. As already indicated, the findings from the prior research has been rather uniform and consistent. First of all, the study of Pinches, Mingo, and Caruthers [Ref.5] "yielded seven factors or classifications of financial ratios that loaded at .70 or greater in either 1951, 1957, 1963, or 1969." [Ref.5,p.390] Loading is a statistical term which refers to the significance which the factor carries in relation to the ratio or unit it applies to or is measured against. As explained in the footnote associated with the previous citation:

> A loading of .70 was chosen since the square of this times 100 equals approximately 50 per cent. Variables with less than 50 per cent common variation with the rotated factor pattern were considered too weak to report. [Ref.5,p.390]

The researchers found, based on the multivariate procedures employed, that there were seven financial ratio factor patterns. The study also showed that these seven patterns occurred for each year examined with two factors showing downward trends, three showing upward trends and the remaining two showing "little overall trend with fairly widespread involvement across financial firms." [Ref.5,p.395] A trend in this sense means which way a factor is heading in terms of importance over a period of time. In other words, if the factor described as *cash flow* is the strongest factor in 1983 and only the fifth strongest in 1988, that would show a downward trend. However, it is important to remember that it

10

is still a factor. Generally, they established that financial ratios which meaningfully describe the financial condition of an industry or an economy may be determined using the empirical methods which have been delineated. Furthermore, they assert that the group of ratios are reasonably stable over time.

The 1975 study conducted by the same researchers with the addition of Arthur A. Eubank took the analysis a step further, conducting what they called higher-order classification. Using this higher-order classification, they pared the factor set down to three factors: Return on Invested Capital, Overall Liquidity, and Short-Term Capital Turnover [Ref.6,p.301]. These "three higher-order groupings... were found to be unique in that they provide more comprehensive groupings of financial ratios and assist in specifying the interrelationships that exist among financial ratios and financial ratio groups." [Ref.6,p.302] The results of their study mirrored those of the 1973 research. Again, while it is important to choose the correct ratios to make a financial evaluation of an industry, empirically-based factor analysis procedures may facilitate the process.

Much of the Chen and Shimerda study was nothing more than a strict scrutiny of the procedures used and ultimate findings of the prior studies. In their study of useful financial ratios, Chen and Shimerda [Ref.4,p.52] found that of all the ratios investigated in 25 studies over a 42 year period only 38 ratios were found useful. It is interesting to note that of the 38 useful ratios, only 19 were found useful in more than one of the studies. They found no serious flaws in the research of their predecessors. However, they state that:

> Each ratio contains common as well as unique information. The common information contained in a ratio is represented by factors. The unique

11

information is not shared by any other ratio in the factor. Consequently, the set of financial ratios used for further analysis should be selected in such a way that the ratios capture most of the common information contained in their factors and, as a group, contain more of the unique information than any other set of ratios. [Ref.4,p.59] While that level of accuracy would be ideal, as of yet it is unattainable. Therefore, the best procedure for determining the most representative ratios for a data set remains factor analysis.

Meanwhile, the findings of Ketz et al. also show seven factors reduced from a larger set of financial ratios. The 32 ratios from which this study starts gets reduced to the following factors: Cash position, cash flow, debt, inventory, liquidity, return, and sales. The analysis admits that the "results are generally consistent with previous research (and)...variations in method and rotation were tried but they generally produced the same results." [Ref.1,p.49]

F. SUMMARY

The state of current knowledge on the subject is that factor analysis works. It works on a set of ratios. The prior researchers directed their research on U.S. industry in general. Overall, they used factor analysis. They used various types of rotation techniques and found that although they all work to a degree, rotated factor patterns worked better than unrotated. For higher level analysis, the prior research used oblique. Nevertheless, orthogonal was the more common methodology. Furthermore, the state of knowledge on the topic asserts that the factors tend to remain stable, if not constant, over time.

Despite the lack of voluminous material on the subject of factor analysis of financial ratios, the prior research on the matter has been useful. In relation to the questions posed in the first chapter of this thesis, the studies cited are directly relevant. Furthermore, the approaches used are

12

consistent with each other and consistent with the methodology to be described in the next chapter.

From the previous studies on factor analysis as applied to standard accounting ratios, the evidence supports a finding that there are seven primary dimensions of financial condition. The seven factors (and the most representative ratio for each factor) cited in the 1973 Pinches et al. study [Ref.5,p.392] are:

1. Return on Investment (Net Income/Net Worth)

2. Capital Intensiveness (Sales/Net Plant)

3. Inventory Intensiveness (COGS/Inventory)

4. Financial Leverage (Debt/Total Capital)

5. Receivables Intensiveness (Receivables/Inventory)

6. Short-term Liquidity (Current Assets/Total Assets)

7. Cash Position (Cash/Expenditures)

Slightly different were the seven factors cited as primary dimensions in the 1975 Pinches et al. study [Ref.6,p.299] when the ratios and factor loadings defined these factors (or classifications of financial ratios):

1. Return on Investment (Net Income/Net Worth)

2. Capital Turnover (Sales/Net Plant)

3. Inventory Turnover (COGS/Inventory)

4. Financial Leverage (Debt/Total Capital)

5. Receivable Turnover (Receivables/Inventory)

6. Short-Term Liquidity (Current Assets/Current Liabilities)

7. Cash Position (Cash/Expenditures)

The Ketz et al. study [Ref.1,p.43] shows the following seven factors of the economy:

1. Return (Operating Income/Sales)

2. Cash Flow (CFO/Sales)

3. Cash Position (Cash/Current Debts)

4. Inventory (COGS/Inventory)

5. Sales (Current Assets/Sales)

6. Liquidity (Current Assets/Current Debts)

7. Debt (Current Debts/Total Debts)

The broad conclusion here is that all of the studies essentially resulted in the same seven factors. Furthermore, similar ratios tended to load on the same factors. Though it has not been reproduced in this document, the studies have found that the primary dimensions of financial condition tend to be stable across time. Finally, not only are the factors in evidence in all the studies; but, the relative importance among the factors tends to be consistent. For instance, all studies listed above show *Return* ranked #1. Meanwhile, liquidity and debt are ranked low in each set of factors.

In conclusion, the findings of the prior research are encouraging. There is adequate evidence upon which to base the assumption that use of the factor analysis procedures will provide sufficient information to address the thesis questions. In the next chapter, the issue of database construction and thesis methodology will be discussed in detail.

III. METHODOLOGY

A. OVERVIEW

The analysis for this thesis was conducted in five steps: (1) Identification of the appropriate sample, (2) Collection of data and input onto a computer database, (3) Selection and calculation of financial ratios, (4) Factor analysis using the mainframe computer, and (5) Preparation of this written thesis documenting the findings and answering the research questions.

The fifty firms used in the study are a representative sample from the 100 Department of Defense contractors listed in the Defense 93 Almanac. [Ref.7] The emphasis was on larger firms, with a mix from various sub-industries within the defense industry such as the automotive, shipbuilding, aerospace and electronics industries. The data was collected from annual reports and Moody's Industrial Manuals over the last ten years, focusing on information contained in balance sheets, income statements and statements of cash flow.

B. IDENTIFICATION OF SAMPLE AND DATA COLLECTION

1. Sample Identification

As discussed above, the sample for this analysis consists of fifty of the top one hundred defense contractors in the United States. The objective in this study was to choose a sample representative of the industry. In a team effort with two other thesis students and the principal advisor, a suitable sample was identified from the companies listed in the 1993 edition of the "Defense 93 Almanac." The Defense 93 Almanac lists the top 100 defense companies in order of dollar volume of Department of Defense prime contracts awarded during fiscal year 1992. Thirty-six of the companies chosen in the sample were among the top fifty companies listed in the Almanac. The remaining 14 were from the 2nd fifty listed in the Almanac. This final mix of firms resulted from a number

15

of considerations:

1. A desire to include some important defense corporations while excluding such entities as oil companies and university based defense research laboratories.

2. Consideration of percentage of income from defense related contracts. Percentage criteria tend to exclude larger corporations which require greater dollar volume to attain the same percent.

3. A concern for covering the spectrum of sub-industries within the defense contract industry. It was desirable to include aviation, automotives, shipbuilding and electronics rather than skewing the database with any one specific sub-industry.

4. Sample size.

The researchers elected to include 50 companies in the sample since that would be sufficient for the statistical testing to be done by all the thesis writers using the database.

The defense related corporations that are included in the sample for this thesis are listed below in alphabetical order:

1. ALLIED SIGNAL

2. AT&T

3. BLACK & DECKER

4. BOEING

5. CHRYSLER

6. COASTAL

7. COMPUTER SCIENCE CORP.

8. CONTROL DATA (CERIDIAN)

9. CSX

10. DYNAMICS

11. EASTMAN KODAK

12. EATON

13. EG&G

14. E-SYSTEMS

15. FMC

16. FORD

17. GENCORP

18. GENERAL DYNAMICS

19. GENERAL ELECTRIC

20. GENERAL MOTORS

21. GRUMMAN

22. GTE

23. HARRIS

24. HARSCO

25. HERCULES

26. HEWLETT-PACKARD

27. HONEYWELL

28. IBM

29. ITT

30. JOHNSON CONTROLS

31. KAMAN

32. LOCKHEED

33. LORAL

34. LTV

35. MARTIN MARIETTA

36. MCDONNELL DOUGLAS

37. MORRISON KNUDSEN

38. MOTOROLA

39. NORTHROP

40. OLIN

41. RAYTHEON

42. ROCKWELL INTERNATIONAL

43. TELEDYNE

44. TEXAS INSTRUMENTS

45. TRINITY

46. TRW

47. UNITED INDUSTRIES

48. UNISYS

49. UNITED TECHNOLOGIES

50. WESTINGHOUSE

2. Data Collection

a. *Time Period Selection*

Data were collected from all fifty corporations for the ten-year period from 1983 through 1992. A ten year period was selected to permit ample subsets of data for comparison against one another. This 10 year period also included a full buildup and drawdown of military capabilities and expenditures in the United States, permitting analysis of separate periods of industry health and decline. A longer time period could have been chosen. However, these data provided adequate observations.

It is important to note here that the nature of business in America over the past decade has become volatile. This was reflected in annual report financial information. The researchers and this author discovered various annual report anomalies caused by: accounting changes, government

18

regulation, government deregulation, antitrust actions, bankruptcies, acquisitions and divestitures. In several cases, the year-to-year consistency of annual reports published by a single corporation was somewhat questionable. The author did not attempt to adjust the information to reconcile the differences. Rather, in those cases where the inconsistencies were severe, data were discarded.

b. Selection of the Items Collected

The items of data that were collected from each of the 50 corporations were taken from the balance sheets, income statements and statements of cash flow.

Although many of the firms provided a complete set of annual reports in response to the researchers' requests, much of the data had to be extracted from Moody's Industrial Manuals. The author traveled to several libraries both in the central coast of California and in the New York metropolitan area. The most profitable investment of time in this regard was the McHenry Library at University of California at Santa Cruz. That library has all varieties of Moody's manuals dating back to 1905. (The Dudley Knox library on campus at the Naval Postgraduate School was wholly inadequate in this regard.)

Once the annual reports and Moody's Manuals had been assembled, the researchers had to decide which specific items were to be catalogued. The rationale was to construct a comprehensive list of numbers from which it would be possible to compute a large number of different financial ratios. A list of those items of data that were collected from each company follows:

1. Cash & Marketable Securities

2. Accounts Receivable & Notes Receivable

3. Inventory

4.   Current Assets

5.   Net Plant, Property & Equipment

6.   Total Assets

7.   Accounts Payable & Accrued Expenses

8.   Current Liabilities

9.   Long Term Debt

10. Other Long Term Liabilities & Deferred Income Taxes

11. Total Liabilities

12. Preferred Stock

13. Retained Earnings

14. Shareholders' Equity

15. Net Sales

16. Cost of Goods Sold

17. Operating Expenses

18. Net Operating Income

19. Interest Expense

20. Income Tax Expense

21. Income From Continuing Operations

22. Net Income

23. Earnings Per Share (continuing operations)

24. Earnings Per Share (discontinued operations)

25. Cash Flow From Operations

26. Working Capital From Operations

27. Net Capital Expenditures

28. Depreciation, Amortization & Depletion

It should be noted here that a few of the items of information collected were of questionable usefulness. Some of the income statement items were negative numbers on a number of reports; and in several cases, Retained Earnings was a negative number, often referred to as "Accumulated Deficit." More rarely, Shareholder's Equity was negative. (In each such case, however, the corporation had just purchased treasury stock or rearranged their capital structure so that total liabilities exceeded total assets.) These negative values were problematic in that they would cause problems which rendered some ratios meaningless. (e.g., return on negative equity has no meaning.) Therefore, these values were discarded from the database.

C. SELECTION OF RATIOS FOR FACTOR ANALYSIS

As discussed in the previous chapter, the purpose of performing the factor analysis procedure is to identify the dimensions of financial condition and determine which ratios are most representative of those dimensions. Thus, it becomes the task of the researcher to determine which ratios to start with and how many to use. A review of the literature led me to choose the same ratios used by Ketz et al. [Ref.1,p.6] Before choosing these ratios, the author ensured they could indeed be calculated with the 28 input variable listed in the previous section. The selected ratios were also considered on the basis of historical usefulness according to the prior studies. By historical usefulness, the author means those ratios which have proven to be most representative of primary dimensions in prior factor analysis studies of ratios. The 32 ratios selected for analysis are listed below:

1. Cash/Current Liabilities

2. Cash/Sales

3. Cash/Total Assets

4.   Cash/Total Debts

5.   Cash Flow/Sales

6.   Cash Flow/Total Assets

7.   Cash Flow/Total Debts

8.   COGS/Inventory

9.   COGS/Sales

10. Current Assets/Current Debts

11. Current Assets/Sales

12. Current Assets/Total Assets

13. Current Debts/Total Debts

14. Inventory/Current Assets

15. Inventory/Sales

16. Inventory/Working Capital

17. Long Term Debt/Total Assets

18. Operating Income/Sales

19. Operating Income/Total Assets

20. Operating Income/Total Debts

21. Operating Income plus Depreciation/Sales

22. Operating Income plus Depreciation/Total Assets

23. Operating Income plus Depreciation/Total Debts

24. Quick Assets/ Current Debts

25. Receivables/Inventory

26. Receivables/Sales

27. Sales/Receivables

28. Sales/Total Assets

29. Total Debts/Total Assets

30. Working Capital/Sales

31. Working Capital/Total Assets

32. Working Capital/Total Debts

D. FACTOR ANALYSIS

1. Factor Analysis in General

In general, factor analysis seeks to find the most effective way to describe a set of measures using the fewest number of factors. "The term *factor analysis* is not a unitary concept, and...the three ordinary steps are (1) the preparation of the correlation matrix, (2) the extraction of the initial factors...and (3) the search for simple and determinable factors." [Ref.3,p469] It applies to all methods of data analysis which use matrix factors. [Ref.2,p.336] The computer program takes the data and rotates them in a number of different ways according to the type of analysis the analyst has chosen to perform. Among the choices available are principal component analysis otherwise known as common factor analysis. Principal factor analysis is statistical method used to ascertain the most common factors in a set. The data matrices for the factor analysis that is to be performed may be rotated or remain unrotated. Rotation is a mathematical procedure akin to matrix algebra which is performed on the database. Generally, rotation of the factors is desirable for finding the most interpretable factors. The rotation pattern could be quadrilateral, orthogonal or oblique. Simply stated, these choices are variations on the level and degree of the computer generated rotation to be performed, and the choice made has implications for the relationship between the data and the factors that result. Orthogonal rotation results in factors that are uncorrelated with each other.

23

For the purposes of this thesis, all factor analysis will use the first order "varimax" orthogonal rotation factor analysis with no limit on the number of factors. This means that the SAS computer system is tasked with rotating the data to an optimal degree to find the common factors.

The varimax procedure stops adding new factors when the variance explained by any new factor is less than the variance within an individual variable. The most common term for variance explained by a factor is its weight or "Eigenvalue." For instance, since the database in question has 32 ratios, the factor analysis strives to explain as many of these ratios as possible using as few factors as necessary. Therefore, using a factor with an Eigenvalue of <1 would make no sense since it does not "capture the weight of even one variable". [Ref.1,p.38] The mathematical model for factor analysis is: [Ref.1,p.29]

$$z_j = a_{j1}F_1 + a_{j2}F_2 + \ldots + a_{jm}F_m + d_jU_j$$

where *a* is the coefficient, F is the common factor, and U is the unique factor.

The purpose of performing the procedure is to find the factors that each ratio loads on and then to determine which ratio loads most significantly on each factor. Loading refers to the correlation between a ratio and a factor. Factor analysis was originally developed in the social sciences to find the common factor among units. The type of factor analysis now routinely used by statisticians is R factor analysis, which takes the ratio of the input variables and finds the common factors of the ratios. This is the most logical procedure when applying factor analysis to the data available in annual reports. More specifically, R factor analysis analyzes the relationship among the numerous ratios constructed from the input variables and finds the representative ratios of those presented. This is the procedure that was used in this thesis.

2. Analysis of the Database

After the identification of the sample, the construction of the database, and a review of the literature, one additional step was conducted prior to the actual factor analysis. Univariate analysis was conducted to find the means, standard deviation and other such routine statistical measures associated with the variables in the database. The procedure was done to search for and eliminate outliers and other unsuitable anomalies. For instance, if the NPLOT (a SAS computer package subroutine which compares variables to determine if they are distributed normally), revealed outlier values for ratios, then those observations were evaluated to decide whether or not to exclude them from the sample prior to performing the factor analysis.

The final step was to perform the factor analysis. The analyst performed varimax rotation on each of the ten years for all 50 companies using 32 different ratios. Then, a year-by-year analysis, using the computer statistical analysis software followed by individual judgement, was performed in order to allow the author to answer the thesis questions.

E. SUMMARY

Each of the preceding chapters as well as this one has been designed to prepare the reader for the analysis section of this thesis. In Chapter IV, the results and findings of the analysis will be discussed for each of the ten years individual and for the ten year period as a whole. Then, the thesis questions will be addressed.

25

IV. DATA PRESENTATION AND ANALYSIS

A. OVERVIEW

This chapter provides the specific data and computer output which was produced in accordance with the methodology described in Chapter III. First, some preliminary observations are made about the data set. Then, the factor matrices are presented and explained. Finally, the information presented is analyzed and the thesis questions answered.

B. DISCUSSION

The data presented in the next section came from a computer run on the Statistical Analysis System (SAS). There are several tables of data extracted and deciphered from the computer output. The appendix at the back of this thesis is composed of 11 tables of data taken directly from the SAS output. Although there is no need to flip back and forth between this chapter and the appendix, the appendix information is germane to the thesis. In this chapter, specific factors were extracted from the rotated factor patterns. While it is important to understand how the factors were determined, it is the analysis of those factors that must be focused on here. As will be shown, the factor analysis proved to be a successful endeavor.

C. PRELIMINARY OBSERVATIONS

1. Communality

Communality is a measurement of the effectiveness of the factor analysis in explaining the individual ratios. The total variance of any given variable accounted for by the common factors is the *communality* of the variable.

27

[Ref.3,p.475] It refers to the amount of variance shared with other variables in the set. So, the complement of communality would be the unique variance, the amount unexplained by the common factors. The communality values are presented in tables 4-1 and 4-2. Observing the data on these tables permits conclusions concerning the degree to which the common factors produced from the factor analysis explained the individual ratios.

The data in Table 4-1 presents the communality for each of the 32 ratios input into the factor analysis computer program for the five year period from 1988 through 1992. Table 4-2 presents the same information for the five year period from 1983 through 1987. Communality is a measurement of the amount of variance in the individual ratios that is explained by the set of factors. Those ratios with higher communality tend to be more useful and more representative than those with low communality. For instance, ratio # 16 (Inv/WC) had a consistently low communality value each year. The value for the ten year period is only .067. Meanwhile, ratio # 6 (CFO/TA) had a ten-year value of .998. Overall, the latter ratio was more representative than the former. Similar evaluations may be made for all the ratios across the rows of the tables or all the years down the columns of the tables.

Looking at Table 4-2, which examines communality for the ratios over the first five years of the study, one can see that the ratios with the highest relative communality values are:

1. Cash/Sales

2. Cash/Total Debt

3. Cash Flow/Total Debt

4. Operating Income/Total Debt

5. (Operating Income plus Depreciation)/Sales

6. (Operating Income plus Depreciation)/Total Debt

7. Working Capital/Total Debt

These seven ratios showed a communality value of .94 or higher for 4 out of the 5 years from 1983 through 1987. A look at Table 4-1 indicates a chronological continuation of the same basic pattern of strong ratios. Specifically, the strongest ratios, according to their relative communality values are:

1. Cash/Current Liabilities

2. Cash/Total Debt

3. Operating Income/Total Debt

4. (Operating Income plus Depreciation)/Sales

5. (Operating Income plus Depreciation)/Total Debt

6. Current Assets/Current Liabilities

7. Working Capital/Total Debt

These ratios showed a communality value of .95 or higher in 4 out of 5 years during the period from 1988 through 1992. On the other hand, those ratios with the lowest communality values, as determined from and evaluation of the vertical columns for each year from both Table 4-1 and Table 4-2, are:

1. 1983, Total Debt/Total Assets, .65

2. 1984, Working Capital/Inventory, .68

3. 1985, Working Capital/Inventory, .63

4. 1986, Sales/Receivables, .63

5. 1987, Sales/Receivables, .58

6. 1988, COGS/Sales, .71

7. 1989, COGS/Sales, .48

29

8. 1990, COGS/Sales, .46

9. 1991, COGS/Sales, .70

10. 1992, COGS/Sales, .38

The lowest overall communality values for the ALL YEAR analysis are (starting from the lowest):

1. Inventory/Working Capital, .06

2. COGS/Sales, .53

3. Sales/Receivables, .54

The remaining 29 ratios all have reasonably high communality values for the ALL YEARS analysis.

What can be concluded about the data presented in Table 4-1 and 4-2 is that factor analysis was an effective method of explaining most of the individual ratios. Thus, it can be concluded that the information contained in the set of 32 ratios is captured well by the much smaller set of factors.

Table 4-1. Communality, All Ratios, 1988-1992

RATIO NO.	RATIO NAME	COMMUNALITY				
		1988	1989	1990	1991	1992
1	CASH/CL	.94	.97	.98	.93	.97
2	CASH/SALES	.91	.95	.93	.93	.94
3	CASH/TA	.75	.93	.89	.86	.88
4	CASH/TD	.96	.94	.97	.98	.97
5	CASH FLOW/SALES	.93	.92	.94	.93	.92
6	CASH FLOW/TA	.89	.96	.89	.96	.93
7	CASH FLOW/TD	.92	.97	.95	.98	.94
8	COGS/INV	.94	.97	.86	.89	.86
9	COGS/SALES	.71	.48	.46	.70	.38
10	CURRENT RATIO	.90	.95	.88	.92	.92
11	CA/SALES	.95	.94	.92	.92	.94

12	CA/TA	.89	.93	.84	.89	.89
13	CURR. DEBT/TD	.97	.98	.93	.95	.91
14	INV/CA	.95	.95	.88	.88	.84
15	INV/SALES	.93	.94	.78	.88	.86
16	INV/WC	.81	.91	.67	.78	.49
17	LTDEBT/TA	.94	.93	.96	.95	.95
18	OPER. INC/SALES	.95	.97	.89	.95	.89
19	OPER. INC/TA	.93	.99	.95	.97	.93
20	OPER. INC/TD	.95	.99	.96	.96	.96
21	(OPINC+DEPR)/SALES	.97	.97	.95	.98	.96
22	(OPINC+DEPR)/TA	.95	.97	.93	.97	.90
23	(OPINC+DEPR)/TD	.96	.96	.97	.97	.92
24	QUICK RATIO	.95	.95	.95	.98	.97
25	REC/INV	.96	.96	.89	.93	.92
26	REC/SALES	.91	.92	.81	.82	.81
27	SALES/REC	.77	.82	.74	.82	.82
28	SALES/TA	.83	.85	.84	.85	.84
29	TD/TA	.85	.85	.91	.95	.92
30	WC/SALES	.93	.96	.92	.91	.93
31	WC/TA	.99	.96	.90	.91	.90
32	WC/TD	.97	.96	.92	.95	.96

Table 4-2. Communality, All Ratios, 1983-1987

RATIO		COMMUNALITY				
NO.	RATIO NAME	1983	1984	1985	1986	1987
1	CASH/CL	.89	.96	.98	.98	.94
2	CASH/SALES	.91	.98	.98	.94	.95
3	CASH/TA	.85	.99	.98	.95	.88
4	CASH/TD	.95	.99	.99	.98	.94
5	CASH FLOW/SALES	.97	.83	.89	.91	.89
6	CASH FLOW/TA	.97	.93	.96	.94	.87
7	CASH FLOW/TD	.97	.97	.99	.97	.94
8	COGS/INV	.92	.91	.91	.92	.89

9	COGS/SALES	.75	.83	.68	.62	.71
10	CURRENT RATIO	.79	.89	.91	.95	.83
11	CA/SALES	.91	.91	.88	.86	.88
12	CA/TA	.85	.95	.95	.94	.80
13	CURR. DEBT/TD	.93	.98	.94	.96	.92
14	INV/CA	.78	.84	.88	.72	.86
15	INV/SALES	.89	.91	.95	.90	.90
16	INV/WC	.71	.68	.63	.69	.79
17	LTDEBT/TA	.90	.95	.94	.97	.93
18	OPER. INC/SALES	.93	.93	.94	.99	.92
19	OPER. INC/TA	.94	.95	.93	.99	.78
20	OPER. INC/TD	.95	.95	.93	.98	.95
21	(OPINC+DEPR)/SALES	.91	.95	.97	.99	.94
22	(OPINC+DEPR)/TA	.87	.94	.95	.98	.94
23	(OPINC+DEPR)/TD	.95	.94	.94	.98	.95
24	QUICK RATIO	.99	.85	.80	.87	.90
25	REC/INV	.97	.86	.89	.92	.90
26	REC/SALES	.94	.84	.84	.90	.63
27	SALES/REC	.86	.76	.75	.63	.58
28	SALES/TA	.98	.94	.93	.94	.89
29	TD/TA	.65	.74	.84	.95	.87
30	WC/SALES	.91	.92	.92	.95	.91
31	WC/TA	.94	.95	.97	.97	.93
32	WC/TD	.95	.95	.97	.95	.91

2. Variance Explained

The literature on the subject of factor analysis specifies the importance of the variance and level of variance explained by the ultimate set of factors found after the analysis has taken place. Variance simply allows the researcher to determine how much may be explained using the

primary dimensions. In other words, variance explained in factor analysis concerns how much of the variance in the ratios is explained by the common factor analysis. The variances have been presented in Table 4.3 below to document the variance explained in all of the analyses.

The table below (Table 4-3) lists the variance explained by the factor analysis program for each year as well as the whole ten year database. The findings displayed show that the yearly variance explained ranged from 87.7% up to 92.8% averaging 90.14%. The variance explained by the factor analysis of the ratios for the ten-year period was 85.3%. In short, the factor procedure for any given year investigated explained about 90% of the variance in the set of 32 ratios. Over the larger database, the variance explained drops to about 85%, which is still acceptable. Overall, what may be concluded from the information provided by the variance is that factor analysis proved to be effective in explaining the collective variance within the complete set of ratios. The factors explain most of the existing variance in the ratios.

YEAR	TOTAL VARIANCE EXPLAINED	NUMBER RATIOS	PERCENT VARIANCE EXPLAINED
1983	28.70	32	89.7
1984	28.96	32	90.5
1985	28.98	32	90.6
1986	29.18	32	91.2
1987	28.05	32	87.7
1988	29.17	32	91.2
1989	29.71	32	92.8
1990	28.24	32	88.3
1991	29.23	32	91.3
1992	28.20	32	88.1
ALL YEARS	27.29	32	85.3

Table 4-3. Variance Explained (by year)

D. PRESENTATION OF FACTOR MATRICES

1. Rotated Factor Patterns

One rotated factor analysis was performed on the ratios for each of the ten years. The factor matrices are provided in the appendix of this thesis. For the purposes of explanation, the Rotated Factor Pattern for one of these years, 1983, is presented in Table 4-4 below. These matrices show the loadings (correlations) between the ratios and the factors.

In order to produce the data provided by these matrices, two steps were necessary. The first step was to conduct the computer analysis using the SAS program and request the software to perform orthogonal rotation of the data. The default for stopping the rotation was an Eigenvalue less than 1. This means that each of the identified factors explains more than any single one of the 32 ratios. Furthermore, the program output lists the columns of factor loadings in priority order whereby the first factor explains more variance (or has a higher Eigenvalue) than the second and so on.

The next step was for the researcher to examine each matrix and make some judgments as to what the pattern meant. The author identified which ratios were correlated with which factors by identifying the single particular factor on which each ratio loaded the highest. These highest loadings are in bold faced type in Table 4-4. Then, the subset of ratios that loaded on a particular factor were identified, e.g. for Factor One in Table 4-4 ratios 9, 18, 19, 20, 21, 22, 23 and 29 loaded most heavily. These ratios were the following:

1. COGS/SALES
2. TOTINC/SALES
3. TOTINC/TA
4. TOTINC/TD
5. (TOTINC+DP)/SALES
6. (TOTINC+DP)/TA

34

7.   (TOTINC+DP)/TD

8.   TD/TA

Once these ratios were identified, the factors had to
be labeled. This step was judgmental and depended on the
researcher's interpretation of what the subset of ratios
collectively measured. The subset of ratios loading on
Factor One in Table 4-4 generally seem to be related to
income. Hence, the label "profit" (or profitability) was
given to the factor. After these steps were completed, the
researcher identified the single ratio that was most
representative of each factor. Usually, this was the ratio
with the highest factor loading on that factor. For the
PROFIT factor just labeled, the Total Income plus
Depreciation/Total Debt ratio had the highest loading.
(These highest loading ratios are bold faced in later
tables.)

The factors for a given year were identified using the
procedure outlined above. Table 4-5 below relates to the
factor loading for 1983. The seven primary dimensions (or
factors) are listed with the respective individual ratios
below them. The Eigenvalues (EV) are displayed. In the
list of individual ratios, the ratio with the highest factor
loading value is highlighted. This table contains the same
results, in more detail, as provided in Table 4-4. Tables
4-6 through 4-16 provide similar information for 1984
through 1992.

Rat.	PROFIT	CF	CF	WC	SALES	DEBT	INV
1	.250	**.756**	.064-	.274	.147	.375-	.135
2	.118	**.866**	.138-	.127	.329-	.066-	.023
3	.061	**.859**	.095-	.214	.049	.229	.020-
4	.242	**.874**	.049-	.301	.005	.132	.139
5	.127	.001	**.961**	.097	.010	.133	.040-
6	.089	.005-	**.963**	.099	.045	.147	.036-
7	.098	.001-	**.964**	.107	.040	.144	.024-
8	.282	.143	.574	.059	**.621**	.323-	.018
9	**.723-**	.024-	.089	.148-	.074-	.441	.038
10	.010	.322	.054	**.760**	.235-	.218-	.002-
11	.117-	.017	.103-	.325	**.881-**	.055-	.040-
12	.253-	.068-	.084	.569	.219-	**.613**	.160-
13	.133	.090-	.096	.196-	.013	**.916**	.137-
14	.199-	.714-	**.382-**	.007	.175-	.155	.179
15	.156-	**.660-**	.354-	.195	.488-	.015	.176
16	.212-	**.591-**	.217-	.464-	.156-	.139	.112
17	.381-	.119-	.084-	.085	.032-	**.813-**	.255
18	**.877**	.276	.075	.041-	.057-	.092	.245-
19	**.706**	.212	.275	.104	.405	.335	.180-
20	**.741**	.258	.315	.185	.385	.225	.030
21	**.881**	.084	.052-	.058-	.284-	.095-	.191-
22	**.818**	.053	.130	.036	.293	.210	.229-
23	**.883**	.166	.181	.168	.258	.115	.007
24	.300-	.184	.061	.147	.040-	.309-	**.860**
25	.001	.060	**.828**	.002	.280	.186-	.416
26	.423-	.221-	.059	.114-	.155-	.150-	**.805**
27	.208	.111	.033-	.046-	**.779**	.424-	.134-
28	.053	.036-	.177	.215	**.772**	.536	.101-
29	**.605-**	.359-	.122-	.369-	.044	.016	.039
30	.130	.200	.030-	**.795**	.380-	.270-	.034
31	.077	.099	.111	**.945**	.119	.078	.001
32	.279	.237	.155	**.876**	.103	.061	.102

Table 4-4.   Rotated Factor Pattern, 1983 (Varimax)

2.   Year-by-Year Analysis

The labeling of the factors (primary dimensions) was carried out for each year. After evaluating which ratios factored together, the researcher made a judgement as to

what those ratios were describing. These judgements were
made in light of all the groupings in a given year. For
instance, while two factors may contain elements that would
make a "sales" label reasonable, it was important to decide
which one better described sales and what the remaining
factor described.

For the most part, the labeling was straightforward.
However, there were two years that the researcher elected to
interpret the results of the factor analysis. Specifically,
although the analysis found nine factors in both 1988 and
1991, the author elected to discard the ninth factors. In
each case, the ninth factor contained only one ratio and the
eigenvalue for both of these identified factors was very
close to 1.

PROFIT EV. = 5.95	CASH POSITION EV = 4.83	CASH FLOW EV = 4.52	WORKING CAPITAL EV = 4.18
COGS/SALES TOTINC/SALES TOTINC/TA TOTINC/TD (TOTINC+DP)/S (TOTINC+DP)/TA **(TOTINC+DP)/TD** TD/TA	CASH/CL CASH/SALES CASH/TA **CASH/TD** INV/CA INV/SALES INV/WC	CFO/SALES CFO/TA **CFO/TD** REC/INV	CA/CL WC/SALES **WC/TA** WC/TD
	SALES EV = 3.73	**DEBT EV = 3.49**	**LIQUIDITY EV = 2.02**
	COGS/INV **CA/SALES** SALES/REC SALES/TA	CA/TA **CL/TD** LTDEBT/TA	**QUICK RATIO** REC/SALES

Table 4-5. Variables Associated with the Factors, 1983.

37

PROFIT EV = 5.48	CASH FLOW EV = 5.31	SALES EV = 4.29	CASH POSITION EV = 4.15
COGS/SALES TOTINC/SALES TOTINC/TA TOTINC/TD (TOTINC+DP)/S (TOTINC+DP)/TA **(TOTINC+DP)/TD**	CFO/SALES CFO/TA **CFO/TD** REC/INV COGS/INV TD/TA	CA/SALES REC/SALES **SALES/REC** SALES/TA	CASH/CL **CASH/SALES** CASH/TA CASH/TA
	WORKING CAPITAL EV = 3.62	INVENTORY EV = 3.09	DEBT EV = 3.03
	CA/CL WC/SALES **WC/TA** WC/TD CA/TA	**INV/CA** INV/SALES INV/WC	**CD/TD** LTDEBT/TA QUICK RATIO

Table 4-6. Variables Associated with the Factors, 1984.

PROFIT EV = 6.38	WORKING CAPITAL EV = 5.69	CASH POSITION EV = 4.43	CASH FLOW EV = 4.26
LTDEBT/TA **TOTINC/SALES** TOTINC/TA TOTINC/TD (TOTINC+DP)/S (TOTINC+DP)/TA (TOTINC+DP)/TD TD/TA	CA/CL WC/SALES **WC/TA** WC/TD CA/TA INV/WC QUICK RATIO	CASH/CL **CASH/SALES** CASH/TA CASH/TA	CFO/SALES CFO/TA **CFO/TD** REC/INV COGS/INV
	SALES EV = 3.39	INVENTORY EV = 2.54	DEBT EV = 2.29
	CA/SALES **REC/SALES** SALES/REC SALES/TA COGS/SALES	**INV/CA** INV/SALES	**CD/TD** SALES/TA

Table 4-7. Variables Associated with the Factors, 1985.

PROFIT EV = 6.64	CASH FLOW EV = 5.28	CASH POSITION EV = 4.50	WORKING CAPITAL EV = 4.45
TOTINC/SALES TOTINC/TA TOTINC/TD (TOTINC+DP)/S (TOTINC+DP)/TA (TOTINC+DP)/TD	CFO/SALES **CFO/TA** CFO/TD REC/INV COGS/INV INV/CA	CASH/CL CASH/SALES **CASH/TA** CASH/TA SALES/REC	CA/CD QUICK RATIO TD/TA **WC/SALES** WC/TA WC/TD
	SALES EV = 3.39	DEBT EV = 2.95	LIQUIDITY EV = 1.98
	COGS/SALES **CA/SALES** INV/SALES REC/SALES SALES/TA	CD/TD INV/WC **LTDEBT/TA**	**CA/TA**

Table 4-8. Variables Associated with the Factors, 1986.

WORKING CAPITAL EV = 5.45	PROFIT EV = 4.64	CASH POSITION EV = 3.68	SALES EV = 3.09
CA/CD QUICK RATIO TD/TA **WC/SALES** WC/TA WC/TD	CA/SALES **TOTINC/TA** TOTINC/TD (TOTINC+DP)/TA (TOTINC+DP)/TD REC/SALES SALES/TA	CASH/CL CASH/SALES **CASH/TA** CASH/TA SALES/REC	COGS/SALES TOTINC/SALES **(TOTINC+DP)/S**
LIQUIDITY EV = 3.09	CASH FLOW EV = 3.08	DEBT EV = 3.00	INVENTORY EV = 1.60
COGS/INV INV/CA **REC/INV**	CASH/CL CASH/SALES **CASH/TA** CA/TA	**CD/TD** LTDEBT/TA	INV/SALES **INV/WC**

Table 4-9. Variables Associated with the Factors, 1987.

PROFIT EV = 5.77	CASH POSITION EV = 5.29	CASH FLOW EV = 3.55	WORKING CAPITAL EV = 2.92
TOTINC/SALES TOTINC/TA TOTINC/TD (TOTINC+DP)/S **(TOTINC+DP)/TA** (TOTINC+DP)/TD COGS/SALES	**CASH/CL** CASH/TA CASH/TD CFO/TA CFO/TD TD/TA	CASH/SALES CFO/SALES **CA/SALES**	WC/SALES **WC/TA** WC/TD
LIQUIDITY EV = 2.87	DEBT EV = 2.68	INVENTORY EV = 2.47	SALES EV = 2.02
COGS/INV CURRENT RATIO QUICK RATIO REC/INV	CA/TA **CD/TD** LTDEBT/TA	INV/CA **INV/SALES**	**REC/SALES**

Table 4-10. Variables Associated with the Factors, 1988.

PROFIT EV = 6.00	CASH POSITION EV = 4.40	WORKING CAPITAL EV = 3.52	SALES EV = 3.51
TOTINC/SALES **TOTINC/TA** TOTINC/TD (TOTINC+DP)/S (TOTINC+DP)/TA (TOTINC+DP)/TD	CASH/CL CASH/SALES **CASH/TA** CASH/TA	INV/WC QUICK RATIO WC/SALES **WC/TA** WC/TD	COGS/SALES **CA/SALES** SALES/TA
LIQUIDITY EV = 2.89	DEBT EV = 2.59	CASH FLOW EV = 2.49	INVENTORY EV = 2.23
COGS/INV CA/CL REC/INV	CA/TA **CD/TD** LTDEBT/TA	CFO/SALES **CFO/SALES** CFO/TD	INV/CA **INV/SALES**
RECEIVABLES EV = 2.08			
REC/SALES SALES/REC			

Table 4-11. Variables Associated with the Factors, 1989.

40

WORKING CAPITAL EV = 5.03	PROFIT EV = 4.90	CASH POSITION EV = 3.74	INVENTORY EV = 3.38
CA/CL INV/WC QUICK RATIO **WC/SALES** WC/TA WC/TD	TOTINC/SALES TOTINC/TA **TOTINC/TD** (TOTINC+DP)/TA (TOTINC+DP)/TD SALES/TA	**CASH/CL** CASH/SALES CASH/TA CASH/TD	COGS/INV INV/CA INV/SALES **REC/INV**
CASH FLOW EV = 2.95	**LIQUIDITY EV = 2.80**	**SALES EV = 2.76**	**DEBT EV = 2.69**
CFO/TA CFO/TD **CA/TA**	**CFO/SALES** CA/SALES (TOTINC+DP)/S	CURRENT RATIO **REC/SALES** SALES/REC SALES/TA	CD/TD **LTDEBT/TA**

Table 4-12.   Variables Associated with the Factors, 1990.

WORKING CAPITAL EV = 5.89	PROFIT EV = 4.97	INVENTORY EV = 3.57	CASH POSITION EV = 3.57
CASH/CL CASH/TD CURRENT RATIO QUICK RATIO TD/TA WC/TA WC/SALES **WC/TD**	TOTINC/SALES **TOTINC/TA** TOTINC/TD (TOTINC+DP)/TA (TOTINC+DP)/TD (TOTINC+DP)/S	**COGS/INV** INV/CA INV/SALES REC/INV	CASH/SALES CASH/TA CFO/SALES CA/TA **CA/SALES**
CASH FLOW EV = 2.79	**DEBT EV = 2.72**	**RECEIVABLES EV = 2.60**	**SALES EV = 1.78**
CFO/TA CFO/TD SALES/TA	**CD/TD** LTDEBT/TA	REC/SALES **SALES/REC**	**COGS/SALES**

Table 4-13.   Variables Associated with the Factors, 1991.

41

WORKING CAPITAL EV = 6.26	PROFIT EV = 5.74	SALES EV = 4.14	INVENTORY EV = 3.26
CASH/CL CASH/TD CURRENT RATIO QUICK RATIO TD/TA WC/TA WC/SALES **WC/TD**	CASH/TA TOTINC/SALES **TOTINC/TA** TOTINC/TD (TOTINC+DP)/TA (TOTINC+DP)/TD (TOTINC+DP)/S	CASH/SALES CFO/SALES **CA/SALES** SALES/TA	**COGS/INV** INV/CA INV/SALES REC/INV
DEBT EV = 2.66	**RECEIVABLES EV = 2.16**	**CASH FLOW EV = 2.09**	**LIQUIDITY EV = 1.88**
COGS/SALES CD/TD **LTDEBT/TA**	**REC/SALES** SALES/REC	**CFO/TA** CFO/TD	**CA/TA** INV/WC

Table 4-14.   Variables Associated with the Factors, 1992.

The analysis clearly shows that the industry remained stable from a factor analysis perspective for the first five year period. What this means is that up through 1987, only seven discernable factors were discovered in the analysis and the factor analysis procedure consistently found the same seven factors in the database.   For the most part, these were:

1. Profitability

2. Working Capital

3. Cash Position

4. Cash Flow

5. Sales Revenue

6. Inventory

7. Debt position

These factors remained stable throughout the period with only slight adjustments in relative position (or rank)

among the factors from one year to the next year. In three
of these years, there was a different factor present.
Liquidity displaced inventory in 1983 and again in 1986.
Then in 1987, liquidity began showing up consistently (each
year except 1991) as a factor. This consistency held
through the remainder of the study.

The second five year period was somewhat more involved
than the first. In that period of time, the factor analysis
revealed at least eight primary dimensions of financial
condition for each year. In 1989, and only 1989, the
researcher found nine dimensions with the ninth being
receivables. The eight factors found over the second five
year period are listed in order of importance:

1. Working Capital

2. Profitability

3. Cash Position

4. Inventory

5. Cash Flow

6. Debt Position

7. Sales Revenue

8. Liquidity

Although *liquidity* becomes a consistent factor after
1987, it is not one of the stronger ones. Also, it should
be noted here that *receivables* displaced liquidity as a
factor in 1991. Then, in 1992, receivables displaced cash
position as a factor.

Observing the data clearly indicates that the same
factors, with only slight variation, are present each year.
Also, the factors do maintain their strength (eigenvalue
levels) with respect to each of the others. For instance,

43

profitability is always either the strongest or second strongest factor and debt is always one of the weaker ones. On the other hand, the number of factors does not remain stable. Through 1986, there are only seven factors. However, the analysis showed at least eight factors after 1986 and nine in 1991. Finally, for most of the factors the same ratios comprise the factor consistently. This is particularly true of the profitability, cash position, cash flow and working capital factors.

3. All Year Analysis

The analysis of the full ten year period was performed in much the same manner as the individual year factor analyses discussed in the previous section. Specifically, the researcher evaluated the loading values and grouped then labeled the identified primary dimensions.

Rat.	PROF	WC	CF	CF	INV	DEBT	LIQ	SALES	LIQ*
1	.011-	.351	**.886**	.018	.063	.029-	.079-	.082-	.077-
2	.001-	.001-	**.652**	.003	.024	.052-	.634	.196-	.036
3	.051	.111	**.875**	.044	.001-	.111-	.193	.158	.134-
4	.051-	.335	**.865**	.048	.001	.242-	.028-	.026-	.020-
5	.080	.029	.047	**.984**	.078	.034-	.049	.065-	.010-
6	.070	.051	.018	**.989**	.080	.035-	.024-	.056	.029-
7	.060	.091	.027	**.984**	.096	.053-	.028-	.040	.012-
8	.093	.181	.073-	.122	**.874**	.025-	.090-	.128	.004-
9	.247-	.081-	.057	.004-	.108	.021-	.051-	**.656**	.092
10	.021-	**.886**	.091	.001	.212	.168	.038-	.033	.061
11	.054-	.097-	.116	.012-	.023	.027-	**.875**	.305-	.148
12	.045	.431	.119-	.020	.001-	.262-	**.628**	.464	.027-
13	.077	.153-	.123	.070	.024	**.926-**	.155	.153	.020-
14	.094-	.138	.223-	.071	**.764-**	.093	.297-	.092	.144
15	.012-	.232	.184-	.072-	**.733-**	.057	.080	.170-	.310
16	.026-	.040	.038	.003-	.083-	.134-	.004	.073	**.182**
17	.130-	.079-	.136-	.049-	.120-	**.953**	.012-	.015-	.023
18	.934	.019-	.025	.036	.025	.001	.143	.151-	.009
19	**.953**	.051	.001	.066	.072	.062-	.047-	.109	.081-
20	**.938**	.024	.022-	.049	.104	.001	.022-	.087	.019
21	**.868**	.075-	.028	.015	.021-	.007-	.168	.415-	.008-
22	**.939**	.011	.022-	.056	.049	.100-	.136-	.024	.162-
23	**.928**	.089	.017	.049	.118	.095-	.109-	.004-	.017-
24	.009	**.571**	.363	.020-	.2472	.198	.258-	.116	.501
25	.063	.119	.134-	.056	**.864**	.013-	.046-	.057	.260
26	.061-	.126-	.059-	.029-	.055	.118	.030	.082-	**.868**
27	.080	.126-	.330	.011	.060	.033	.145-	.122	**.603-**
28	.157	.187	.060-	.048	.136	.159-	.261-	**.771**	.296-
29	.128-	**.592-**	.192-	.044-	.159-	.520	.392	.193	.019
30	.024	**.843**	.211	.027	.195-	.007	.186	.223-	.078
31	.092	**.888**	.063	.082	.117	.011	.054	.246	.070-
32	.023-	**.871**	.294	.112	.004	.189-	.072-	.036	.027-

Table 4-15.   Rotated Factor Pattern Loading, All Years

Table 4-16 below is a summary of the primary dimensions of financial condition uncovered in the factor analysis process for the run on the ALLYEARS data listed above. It represents the crux of this thesis and best assists the author in answering the research questions.

The table below (Table 4-17) is a summarization of Table 4-5 through Table 4-14 and also Table 4-16. In other words, it lists the factors for each year according to their relative strength as a primary dimension within each year.

PROFIT EV = 5.37	WORKING CAPITAL EV = 4.42	CASH POSITION EV = 3.33	CASH FLOW EV = 3.00
TOTINC/TA TOTINC/TD TOTINC+DEP/SAL **TOTINC+DEP/TA** TOTINC+DEP/TD	CURRENT RATIO QUICK RATIO TD/TA WC/SAL **WC/TA** WC/TD	**CASH/CL** CASH/SAL CASH/TA CASH/TD	CFO/SAL **CFO/TA** CFO/TD

INVENTORY EV = 2.93	DEBT EV = 2.38	LIQUIDITY EV = 2.17	SALES EV = 1.90
COGS/INV INV/CA INV/SAL REC/INV	CD/TD **LTDEBT/TA** **RECEIVABLES EV = 1.78** INV/WC **REC/SAL** SAL/REC	**CA/SAL** CA/TA	COGS/SAL **SALES/TA**

Table 4-16. Variables Associated with the Factors, All Years.

YEAR	FACTORS								
	1	2	3	4	5	6	7	8	9
1983	PROF	CP	CF	WC	SALE	DEBT	LIQ	---	---
1984	PROF	CF	SALE	CP	WC	INV	DEBT	---	---
1985	PROF	WC	CP	CF	SALE	INV	DEBT	---	---
1986	PROF	CF	CP	WC	SALE	DEBT	LIQ	---	---
1987	WC	PROF	CP	SALE	LIQ	CF	DEBT	INV	---
1988	PROF	CP	CF	WC	LIQ	DEBT	INV	SALE	---
1989	PROF	CP	WC	SALE	LIQ	DEBT	CF	INV	REC
1990	WC	PROF	CP	INV	CF	LIQ	SALE	DEBT	---
1991	WC	PROF	INV	CP	CF	DEBT	REC	SALE	---
1992	WC	PROF	SALE	INV	DEBT	REC	CF	LIQ	---
All	PROF	WC	CP	CF	INV	DEBT	LIQ	SALE	REC

Table 4-17. Factors of Financial Condition (by year)

It is clear from the data presented that the factors present in the factor pattern for the entire ten-year period are as follow, in order of magnitude:

46

1. Profitability

2. Working Capital

3. Cash Position

4. Cash Flow

5. Inventory

6. Debt

7. Liquidity

8. Sales

9. Receivables

4. Representative Ratios

The table below (Table 4-18) reiterates the eight most common factors or primary dimensions. Also, the specific ratios composing each of the factors are listed below them.

	PROF	WC	CP	CF	INV	DEBT	LIQ	SALE
1983	23	31	4	7		13	24	11
1984	21	31	2	7	14	12		27
1985	18	31	2	7	14	13		26
1986	18	30	3	6	17	12		11
1987	19	31	3	6	21	13		25
1988	22	31	1	8	15	13	25	26
1989	19	31	1	6	15	13	8	11
1990	20	30	1	12	25	17	5	26
1991	19	32	11	6	16	13		27
1992	19	32	11	6	8	17	12	26

Table 4-18. Strongest Ratios Within the Factors, by Year

47

For a listing of the ratio names associated with the number, the reader may refer to the appendix.

The strongest individual ratios for the ten-year period are:

1. (Total Income plus Depreciation)/Total Assets

2. Working Capital/Total Assets

3. Receivables/Sales

4. Cash/Current Liabilities

5. Cash Flow from Operations/Total Assets

6. Costs of Goods Sold/Inventory

7. Long Term Debt/Total Assets

8. Current Assets/Sales

These ratios, again, represent the most significant ratios with each of the of the main factors. Table 4-18 is a compilation of the ratios with the highest factor loadings for each of the ten years for each of the ascertained factors. Four of the strongest ratios for the full period also were prevalent in the yearly analyses. The six most common ratios are listed below with the repeats from the ALLYEAR list highlighted:

1. **Working Capital/Total Assets (Ratio #31)**

2. **Cash Flow from Operations/Total Assets (Ratio #6)**

3. Current Debt/Total Debt (Ratio #13)

4. **Current Assets/Sales (Ratio #11)**

5. Total Income/Total Assets (Ratio #20)

6. **Receivables/Sales (Ratio #26)**

E. ANSWERS TO RESEARCH QUESTIONS

1. The Primary Question

What are the primary dimensions of financial condition for firms within the defense industry?

As one can see from the data presented and the analysis of that data, there are nine primary dimensions of financial condition for firms within the U.S. Defense Industry. They are: **profitability, working capital, cash position, cash flow, inventory, debt, and liquidity, sales and recivables** in that order. This was demonstrated by the factor analysis program. These nine factors account for over 85% of the variance in financial ratios in the database of 50 firms over a ten year period.

2. Secondary Questions

Which individual ratios are most representative of the primary dimensions of financial condition within the industry?

Each of the nine factors listed in the preceding paragraph has an associated individual ratio which is most representative of the primary dimensions of financial condition within the industry. They are taken directly from the ALLYEAR analysis. They are:

1. (Total Income plus Depreciation)/Total Assets

2. Working Capital/Total Assets

3. Cash/Current Liabilities

4. Cash Flow from Operations/Total Assets

5. Costs of Goods Sold/Inventory

6. Long Term Debt/Total Assets

7. Current Assets/Sales

8. Sales/Total Assets

9. Receivables/Sales

What subset of ratios most effectively captures the full range of those financial dimensions?

The subset of ratios which most effectively capture the full range of those financial dimensions are:

1.   (Total Income plus Depreciation)/Total Assets

2.   Working Capital/Total Assets

3.   Cash Flow/Total Assets

4.   Current Assets/Sales

These four ratios are that subset of ratios which were significant in both the full ten-year period and in the evaluation of each of the ten years individually. The two most powerful ratios by far are the first two.

Are the dimensions of financial condition stable across time?

It is clear from a visual examination of Table 4-17 that the dimensions of financial condition are most certainly stable across time. Six of the eight dimensions are present in each of the ten years as well as in the whole period. *Inventory* is a primary dimension in all years except 1983. Also, *Liquidity* is present in 7 of the 11 sets of primary dimensions outlined in the illustration. From another perspective, not only do all of the dimensions remain present, but their position in the set of primary dimensions remains stable over the time period investigated. *Profitability* was locked into the #1 or #2 position for all of the years. Although *Working Capital* started the ten-year period as a median dimension, it indicated an upward trend in 1985 and continues to do so. As of now, it is the most significant primary dimension even though it ranks #2 for the whole database.   Therefore, there is little doubt that these dimensions are consistent across time. *Cash position, Cash Flow, and Inventory* maintained a middle position as

primary dimensions throughout the study. Finally, *Debt, Sales and Receivables* consistently brought up the rear in terms of priority of primary dimensions.

Are the ratios that are most representative of each dimension consistent across time?
As far as consistency over time of the individual ratios is concerned, it depends on the factor which is being looked at. Whereas the ratios most representative of most of the primary dimension were somewhat consistent over time, it was not so in every case. Specifically, the individual ratios most representative of inventory and liquidity were inconsistent. Otherwise, the most representative ratios did remain consistent over time.

To what degree are different aspects of financial condition correlated?
Naturally, the different aspects (or ratios) within each factor are correlated. However, the factors themselves are by definition "uncorrelated." As indicated in section B of this chapter, orthogonal rotation requires that the factors be constructed to be uncorrelated.

How are the identified major dimensions and representative ratios related to economic growth and decline?
Finally, the major dimensions which have been identified and their representative ratios are not related to economic growth and decline. The first five years of this study period encompassed a period of economic growth and the last five years saw the economic decline due to the recession in conjunction with the drawdown of the Department of Defense. Nevertheless, the primary dimensions of financial condition have remained stable. Therefore, the dimensions are not related to financial growth and decline.

F. SUMMARY

Overall, the factor analysis procedure proved to be an effective method of discovering the primary dimensions of financial condition within the defense industry. The process reduced the data set from 32 variables to nine factors. Nevertheless, the nine remaining factors still account for over 85% of the total variance in the 32 original ratios. Furthermore, these factors remained relatively stable over time. One conclusion which can be made here is that specific ratios, when chosen properly, may be just as useful for predictive purposes as a much larger set of ratios. In Chapter V the author will draw the final conclusions and recommend further research in the area.

V. CONCLUSION

A. OVERVIEW

The objective of this thesis was to apply factor analysis to the financial ratios of United States defense firms. This was done in order to determine the primary dimensions of financial condition for the defense industry. Similar studies using that methodology have been performed on U.S. industry in general. However, no such study had been performed on the defense industry in particular. It was an advantageous time to perform such an analysis on this industry since it has recently undergone a period of economic decline following several years of economic growth due to the buildup of the Reagan era.

Although much of the literature in this area was written over a decade ago, it is nevertheless pertinent. The available literature was sufficient to allow a researcher to understand the concept of factor analysis and the most effective steps to take in conducting a factor analysis study.

The methodology employed to conduct the thesis consisted of the following steps. In conjunction with two other thesis students, the author constructed a database. This database included financial data from 50 different defense contracting firms in the United States. The data from these companies was gathered over the course of several months in order to cover a period from 1983 through 1992. After collection of the raw data reference material, the data was input by the researchers into a computer database. Thirty-two financial ratios were computed from the raw data. Thereafter, a SAS program was written and executed to perform factor analysis on the ratios. The analysis was performed on each year of the ten-year period and again on the ten-year period as a single entity. Then, the output

53

from the factor analysis programs was analyzed and the tables documented in Chapter IV and the Appendix were constructed. Finally, this thesis was written to document the problem, the process and the findings.

B. REVIEW OF THE FINDINGS

The factor analysis procedure was an effective method of discovering the primary dimensions of financial condition within the defense industry. The factor analysis process reduced the data set from 32 variables to seven, eight or nine factors. This is a 72% to 81% reduction in the data set. The remaining factors still account for over 85% of the total variance existing within the original set of 32 ratios. Furthermore, these factors remained stable over time with only slight changes noticed over the course of economic growth and decline. While the primary dimensions of financial condition were both stable and consistent over time, it is important to remember that these factors resulted from a statistical process, done by a computer program, and a judgmental labelling process, conducted by the researcher. The nine primary dimensions as labeled by the researcher are:

1. Profit

2. Working Capital

3. Cash Position

4. Cash Flow

5. Inventory

6. Debt

7. Liquidity

8. Sales

9. Receivables

C. PROBLEMS ENCOUNTERED

There were several problems encountered over the course of preparing this document. At the outset, the problem was coordination of effort. Whenever a researcher has to rely on the efforts of another researcher, he or she becomes subject to the timetable of the fellow researchers. Luckily, the author's timetable was less restrictive than those of the other researchers. Therefore, that problem was essentially mitigated.

The next problem was that of gathering the data. Often corporations were quite helpful in providing the requested information in the way of annual reports and (in some cases) excerpts from the annual reports of prior years. That information which could not be obtained from communication with the companies was extracted from Moody's Industrial Manuals. This was a problem for two reasons. First, these manuals were not available at the Dudley Knox Library on campus at the Naval Postgraduate School. *Moody's* manuals were found at McHenry Library at University of California in Santa Cruz. Second, the information reported in these manuals for several of the companies was less than comprehensive.

Finally, the last problem encountered (although perhaps the most difficult to resolve) was gaining familiarity with the software. Coming into this thesis, the author had no exposure to either factor analysis or the SAS program. Luckily, there was relative familiarity with *Wordperfect*, *LOTUS*, *MINITAB*, and the mainframe computer. This familiarity proved to be vital in completing all of the various steps to this thesis process.

D. RECOMMENDATIONS FOR FUTURE STUDY

While this thesis focused on factor analysis of the U.S. Defense Contracting Industry over the previously stated

period of time, there are numerous variations on the same theme which may provide fertile ground for further research in the general area of this study. First, future researchers can add to the existing database. The obvious steps in this regard are to fill in whatever missing data points there may be in this database. Thereafter, potential researchers could expand either the time frame or the number of companies.

Another extension that would be possible but difficult would be to expand the number of financial data items from each company. Although the raw research data is available from the principal advisor, this task would be most tedious. However, to expand the number of ratios employed in the analysis would be a simple matter. Additionally, a future researcher might consider experimenting with different techniques in the SAS program to see if the results differ significantly. For instance, one could perform varimax, quartimax and oblique analysis and document the differences.

Finally, a future researcher may perform a similar analysis with firms from a different industry. Although such a study may be interesting in any given industry (or sub-industry), the defense industry is the most relevant industry for thesis studies at the Naval Postgraduate School.

APPENDIX

This appendix is a listing of part of the computer
output from running the SAS factor analysis program.
Specifically, the Appendix is composed of 11 tables. These
tables reproduce the SAS output for the Rotated Factor
Pattern for each year from 1983 through 1992; and the
pattern for the entire ten year period using the full
sample. To interpret these tables, the reader must scan
across the rows looking for the highest absolute values,
e.g., the greatest numerical value without regard to the
sign. The greatest absolute value in each row will signal
the factor upon which the associated ratio loads most
heavily. The tables in this appendix are provided for the
purpose of providing evidence of the findings directly in
the document. It would be cumbersome to include these
tables in Chapter IV. Thus, they are presented here. Also,
for ease of understanding, the list of ratios is reproduced
below:

1.   Cash/Current Liabilities

2.   Cash/Sales

3.   Cash/Total Assets

4.   Cash/Total Debts

5.   Cash Flow/Sales

6.   Cash Flow/Total Assets

7.   Cash Flow/Total Debts

8.   COGS/Inventory

9.   COGS/Sales

10. Current Assets/Current Debts

11. Current Assets/Sales

12. Current Assets/Total Assets

13. Current Debts/Total Debts

14. Inventory/Current Assets

15. Inventory/Sales

16. Inventory/Working Capital

17. Long Term Debt/Total Assets

18. Operating Income/Sales

19. Operating Income/Total Assets

20. Operating Income/Total Debts

21. Operating Income plus Depreciation/Sales

22. Operating Income plus Depreciation/Total Assets

23. Operating Income plus Depreciation/Total Debts

24. Quick Assets/ Current Debts

25. Receivables/Inventory

26. Receivables/Sales

27. Sales/Receivables

28. Sales/Total Assets

29. Total Debts/Total Assets

30. Working Capital/Sales

31. Working Capital/Total Assets

32. Working Capital/Total Debts

Table I. 1983 Rotated Factor Pattern

R1	0.25013	0.75591	-0.06397	0.27397	0.14659	-0.37491	0.13521
R2	0.12812	0.86568	-0.13794	0.12729	-0.32936	-0.06586	0.02281
R3	0.06213	0.85910	-0.09534	0.21405	0.04888	0.22814	-0.01996
R4	0.24213	0.87475	-0.04916	0.30147	-0.00490	0.13231	0.13869
R5	0.12676	0.00111	0.96065	0.09745	0.01005	0.13313	-0.03987
R6	0.08934	-0.00534	0.96303	0.09880	0.04521	0.14710	-0.03603
R7	0.09816	-0.00045	0.96390	0.10653	0.04041	0.14400	-0.02372
R8	0.29159	0.14333	0.57434	0.05924	0.62132	-0.32346	0.01847
R9	-0.72274	-0.02376	0.08948	-0.14752	-0.07350	0.44126	0.03837
R10	0.01015	0.32189	0.05425	0.76039	-0.23543	-0.21843	-0.00214
R11	-0.11699	0.01703	-0.10267	0.32531	-0.89141	-0.05456	-0.03956
R12	-0.25330	-0.06820	0.08393	0.56897	-0.21899	0.61345	-0.16028
R13	0.13203	-0.08961	0.09578	-0.19592	0.01320	0.91691	-0.13660
R14	-0.19941	-0.71377	-0.38159	0.00730	-0.17539	0.15486	0.17925
R15	-0.15577	-0.66000	-0.35389	0.19483	-0.48769	0.01499	0.17621
R16	-0.21208	-0.59127	-0.21673	-0.46401	-0.15573	0.13867	0.11202
R17	-0.38059	-0.11938	-0.08370	0.08457	-0.03233	-0.81299	0.25547
R18	0.87725	0.27634	0.07527	-0.04149	-0.05737	0.09241	-0.24528
R19	0.70568	0.21157	0.27495	0.10382	0.40504	0.33480	-0.18045
R20	0.74095	0.25774	0.31461	0.18479	0.38514	0.22462	0.02990
R21	0.88078	0.08387	-0.05184	-0.05818	-0.28378	-0.09452	-0.19086
R22	0.81806	0.05274	0.13038	0.03633	0.29262	0.20976	-0.22916
R23	0.88272	0.16555	0.18059	0.16796	0.25759	0.11494	0.00747
R24	-0.29999	0.18425	0.06149	0.14716	-0.03954	-0.30941	0.85980
R25	0.00083	0.05986	0.82780	0.00161	0.28004	-0.18573	0.41571
R26	-0.42261	-0.22111	0.05861	-0.11436	-0.15487	-0.14978	0.80535
R27	0.20775	0.11065	-0.03257	-0.04610	0.77919	-0.42405	-0.13400
R28	-0.05257	-0.03603	0.17713	0.21507	0.77227	0.53573	-0.10055
R29	-0.60507	-0.35914	-0.12226	-0.36854	0.04367	0.01563	0.03883
R30	0.13041	0.20036	-0.03039	0.79508	-0.37975	-0.26959	0.03365
R31	0.07672	0.09933	0.11128	0.94460	0.11860	0.07835	0.00059
R32	0.27878	0.23743	0.15536	0.87579	0.10326	0.06138	0.10232

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
5.948044	4.830644	4.516239	4.180381	3.728479	3.485575	2.015063

Final Communality Estimates: Total = 28.704424

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Table II. 1984 Rotated Factor Pattern

R1	0.11636	0.28044	0.12793	0.86949	0.10891	-0.23912	-0.16952
R2	0.17127	0.02391	-0.01272	0.97012	-0.00964	-0.08378	0.06941
R3	0.03558	0.02808	0.32258	0.90531	0.11813	-0.13774	0.16299
R4	0.14649	0.37051	0.13688	0.85616	0.10018	-0.15103	0.20876
R5	0.29137	0.80896	0.17326	0.23166	0.00649	0.04260	-0.03658
R6	0.16168	0.78921	0.43453	0.22322	0.12009	-0.10081	0.12852
R7	0.17906	0.89235	0.18824	0.18497	0.18571	-0.16248	0.11537
R8	-0.10168	0.71940	0.20472	0.02412	0.17333	-0.54506	0.09405
R9	-0.83817	0.08797	0.24343	0.10773	-0.17368	-0.13016	0.02385
R10	0.08342	0.36552	-0.37859	0.00832	0.57601	-0.19692	-0.48070
R11	0.11130	-0.14550	-0.79284	-0.02307	0.39228	0.27908	-0.11407
R12	-0.07405	-0.17048	-0.03711	0.11083	0.83697	-0.20708	0.39340
R13	0.20114	0.13624	0.15205	0.13222	-0.09381	-0.03795	0.93431
R14	-0.26422	-0.25891	-0.08098	-0.29416	0.01635	0.78316	0.01376
R15	-0.16126	-0.27818	-0.43110	-0.26904	0.18597	0.71123	-0.07243
R16	-0.40472	0.02141	0.01471	-0.37905	-0.19388	0.57822	0.04734
R17	-0.31444	-0.26339	-0.01562	-0.10428	0.14587	0.00856	-0.86278
R18	0.90599	0.17186	-0.00687	0.18460	0.05285	-0.19367	0.08107
R19	0.66861	0.22194	0.46302	0.15049	0.13676	-0.34536	0.27673
R20	0.65782	0.54274	0.20723	0.13496	0.14697	-0.28935	0.24413
R21	0.94230	0.10547	-0.15745	0.15609	-0.01067	-0.00303	-0.01166
R22	0.77088	0.15377	0.42205	0.16256	0.08650	-0.22045	0.25301
R23	0.75091	0.50530	0.12792	0.15113	0.08619	-0.16897	0.21386
R24	0.13201	0.22501	-0.38075	0.37170	0.33254	-0.42478	-0.45927
R25	-0.07645	0.69268	-0.07241	0.01627	0.22821	-0.56464	0.05255
R26	0.06410	-0.26293	-0.81276	-0.25929	0.17808	0.08287	0.01311
R27	0.13742	0.09943	0.81857	0.16032	-0.06987	0.16838	0.00956
R28	-0.07616	0.01427	0.76680	0.02012	0.23748	-0.35832	0.40687
R29	-0.44429	-0.61300	0.37215	-0.05412	0.11340	0.06568	-0.09969
R30	0.26148	0.16718	-0.32257	0.03645	0.73294	0.18379	-0.38741
R31	0.11568	0.22233	0.03201	0.11448	0.90536	-0.00098	-0.23514
R32	0.22797	0.59785	-0.11182	0.10211	0.70840	-0.05410	-0.12166

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
5.475164	5.314562	4.285597	4.145810	3.619173	3.094225	3.029468

Final Communality Estimates: Total = 28.963998

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Table III. 1985 Rotated Factor Pattern

Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
R1	0.16768	0.16630	0.95487	0.01695	-0.08975	-0.06468	-0.01859
R2	0.22165	-0.03018	0.95858	0.04988	0.06364	0.02825	-0.03259
R3	0.16829	0.06693	0.93420	-0.03908	-0.24517	0.02032	0.10752
R4	0.22276	0.10665	0.95075	0.04267	-0.06123	-0.04866	0.11209
R5	0.28425	-0.05412	0.19577	0.82576	0.18405	0.06915	-0.22010
R6	0.28479	0.06067	0.12954	0.90591	-0.17051	-0.05993	0.04560
R7	0.24826	0.22589	0.03712	0.91780	-0.04878	-0.15959	0.07009
R8	0.08145	0.23922	-0.21839	0.73455	-0.30228	-0.37302	0.16982
R9	-0.27184	-0.36412	-0.21813	0.19207	-0.61889	0.05437	0.05433
R10	0.01622	0.88898	-0.08091	0.26824	0.16909	-0.07138	-0.10645
R11	-0.00798	0.33125	-0.06282	0.02300	0.76457	0.39590	-0.15278
R12	0.02958	0.71681	-0.01209	-0.03667	-0.00302	0.23028	0.61373
R13	0.47520	-0.25620	0.10802	0.12577	-0.00147	0.00040	0.78716
R14	-0.32373	-0.08801	0.00110	-0.28550	0.05838	0.82499	-0.00032
R15	-0.21573	0.11703	-0.04746	-0.20667	0.40469	0.82113	-0.07045
R16	-0.30981	-0.60235	-0.15244	0.07578	-0.08641	0.35034	0.11539
R17	-0.66093	0.10508	-0.11929	-0.15926	-0.12671	0.16828	-0.63889
R18	0.94035	0.06081	0.18054	0.12971	0.02905	-0.02914	-0.00785
R19	0.88955	0.14103	0.16556	0.15194	-0.19586	-0.06354	0.16113
R20	0.82096	0.25223	0.12505	0.35449	-0.11437	-0.11748	0.14988
R21	0.92248	0.02262	0.19385	0.08221	0.23058	-0.08819	-0.10020
R22	0.88506	0.12406	0.19184	0.07684	-0.16474	-0.17560	0.22518
R23	0.80660	0.26201	0.15566	0.33335	-0.02165	-0.23819	0.16806
R24	0.05642	0.74613	0.31128	0.03632	0.27800	-0.24390	-0.03529
R25	0.05845	0.32717	-0.27903	0.70830	-0.05249	-0.40419	0.17344
R26	-0.06707	0.22067	-0.24220	-0.12465	0.83177	0.15331	0.01911
R27	0.16513	-0.07728	0.42918	0.04001	-0.65600	0.13631	-0.28080
R28	0.07869	0.25186	0.04767	-0.05801	-0.64105	-0.17594	0.63940
R29	-0.52065	-0.36028	-0.08473	-0.35734	-0.33520	0.43356	0.09331
R30	0.13123	0.85434	0.04681	0.05959	0.33407	0.17442	-0.16554
R31	0.09564	0.96200	0.06899	0.07952	-0.03967	0.07716	0.13414
R32	0.17989	0.88466	0.00760	0.37154	0.02652	-0.05376	0.10272

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
6.379240	5.687985	4.429639	4.260644	3.392025	2.541578	2.291692

Table IV. 1986 Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
R1	-0.33591	0.01473	0.88816	0.21179	-0.04143	-0.09261	-0.14580
R2	-0.00653	0.02520	0.95037	0.02178	0.11310	-0.00829	-0.16536
R3	-0.01248	0.00876	0.96229	-0.03284	-0.13750	-0.04992	0.05874
R4	-0.41341	0.03916	0.85995	0.16703	-0.02983	-0.20302	-0.03295
R5	0.17252	0.87768	0.18912	0.12164	0.19291	0.01372	-0.15999
R6	0.14311	0.93266	0.10886	0.11611	-0.09788	-0.04240	0.12056
R7	-0.01016	0.93192	0.07852	0.26255	-0.03079	-0.14285	0.03684
R8	0.03082	0.88065	-0.15125	0.17940	-0.23298	0.04702	0.17392
R9	-0.33416	-0.01353	-0.16569	-0.05177	-0.67916	0.13178	0.05908
R10	-0.31331	0.31767	-0.11794	0.85319	0.03306	0.07246	0.01153
R11	-0.01424	-0.05114	-0.12410	0.20734	0.88248	0.12579	0.00823
R12	0.03135	0.11579	-0.19283	0.30323	0.05053	-0.09683	0.88720
R13	-0.16629	0.10402	0.21422	-0.36571	-0.03413	-0.74151	0.43284
R14	-0.19172	-0.63159	-0.16429	-0.08532	0.40864	0.05124	0.28279
R15	-0.14621	-0.50553	-0.20199	0.00795	0.71426	0.09406	0.25448
R16	0.07156	-0.15756	-0.15398	0.18470	0.05220	-0.77564	-0.01125
R17	0.10480	-0.13088	-0.11611	0.00287	0.05148	0.95012	-0.15358
R18	0.97896	0.07205	-0.06092	-0.11071	0.03386	0.07988	-0.04493
R19	0.97675	0.09090	-0.07974	-0.10756	-0.05611	0.05458	0.05255
R20	0.96361	0.06104	-0.16655	-0.14300	0.00013	0.04974	0.02655
R21	0.96103	0.07811	-0.02456	-0.14134	0.15742	0.06206	-0.09970
R22	0.97186	0.10328	-0.04539	-0.14542	-0.02814	0.01159	0.06648
R23	0.96894	0.08638	-0.14045	-0.13245	0.01778	-0.00411	0.01973
R24	-0.28105	0.13155	0.08440	0.85759	0.00934	-0.16643	-0.08777
R25	0.05351	0.87708	-0.24839	0.24971	-0.07325	0.01060	0.14128
R26	0.07852	-0.17255	-0.52466	0.18428	0.68774	-0.22691	-0.00334
R27	0.07960	0.00998	0.61350	-0.15957	-0.41266	0.21380	0.08708
R28	0.08136	0.10242	0.00177	0.03922	-0.69477	-0.21424	0.62717
R29	0.20138	-0.22725	-0.08858	-0.47757	0.01520	0.74320	0.25577
R30	-0.06699	0.15986	0.08637	0.86383	0.39683	-0.04704	0.06546
R31	-0.05698	0.26776	0.02444	0.85898	0.05334	-0.06152	0.38255
R32	-0.44347	0.38323	0.14684	0.72888	0.06350	-0.12256	0.19495

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
6.641954	5.275110	4.495377	4.449548	3.389904	2.948791	1.980549

Final Communality Estimates: Total = 29.181233

Table V. 1987 Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
R1	0.42375	0.08896	0.82438	0.04591	-0.03411	0.23731	-0.11530	-0.01796
R2	-0.04841	-0.43529	0.79820	0.31257	-0.01360	-0.00615	0.13864	-0.03234
R3	0.09192	0.05048	0.90711	0.08998	-0.13012	0.05701	0.07235	-0.12577
R4	0.39270	0.16622	0.81247	0.08012	-0.03689	0.25884	0.15461	0.04290
R5	-0.13345	-0.32608	0.15761	0.48118	-0.08486	0.70627	0.07121	-0.05770
R6	-0.07520	0.20467	0.11161	0.28618	-0.20315	0.81786	0.11033	-0.09520
R7	0.26704	0.28183	0.27484	0.20193	-0.14755	0.78132	0.19558	0.05265
R8	0.09300	0.20485	-0.09455	-0.10543	0.88199	-0.18444	0.06659	-0.06205
R9	-0.16946	0.00224	0.05173	-0.71182	0.29106	-0.07102	-0.09684	0.26190
R10	0.84744	0.05444	0.05440	-0.08258	0.21217	-0.05142	-0.19989	0.09182
R11	-0.19017	-0.76268	0.19350	0.29958	0.05120	-0.19145	0.28458	0.11690
R12	0.22328	-0.12204	-0.04866	0.00419	-0.02387	-0.61763	0.59721	-0.04821
R13	-0.15824	0.18316	0.10693	0.03842	0.10090	0.03502	0.91560	0.03025
R14	0.23788	0.19637	-0.06814	-0.14332	-0.66834	-0.01601	-0.37573	0.38956
R15	0.17168	-0.23910	-0.04730	0.18684	-0.51689	-0.19461	-0.30047	0.61564
R16	-0.06937	-0.17071	-0.13409	-0.10947	-0.12402	0.02688	0.15421	0.82537
R17	-0.15357	-0.17457	-0.07847	-0.03271	-0.16384	-0.19629	-0.89694	-0.03390
R18	-0.02050	0.16561	0.24469	0.82194	0.18366	0.27464	-0.01902	0.21040
R19	0.07993	0.83227	0.10682	0.32482	0.21633	0.15308	0.19819	0.02118
R20	0.42206	0.62401	0.27541	0.16772	0.32194	0.29148	0.26194	0.12862
R21	-0.02036	0.01698	0.17074	0.91724	-0.02293	0.25359	0.02431	-0.05432
R22	0.09384	0.81442	0.02564	0.40483	0.02034	0.13538	0.18853	-0.21244
R23	0.48463	0.61032	0.23129	0.24150	0.21616	0.31355	0.29068	0.01217
R24	0.85919	0.13219	0.07083	0.06259	0.22975	0.09703	-0.27140	0.01736
R25	0.11575	0.03463	-0.17549	-0.00200	0.91742	-0.13106	0.03849	-0.02690
R26	0.11967	-0.52742	-0.31525	0.37986	0.20626	0.06904	-0.07179	0.21457
R27	-0.33367	0.30230	0.43782	-0.34364	-0.09823	0.05550	0.02791	-0.23711
R28	0.16150	0.77299	-0.13046	-0.40763	0.05581	-0.20139	0.14790	-0.12546
R29	-0.66580	-0.32624	-0.11602	-0.02930	-0.18925	-0.36564	-0.34624	-0.11242
R30	0.85968	-0.17070	0.11801	0.21144	-0.23929	-0.09004	0.11287	-0.07810
R31	0.87795	0.14589	0.02292	-0.09097	-0.22104	-0.23976	0.10873	-0.10199
R32	0.86528	0.26085	0.25749	0.00360	-0.03292	0.04682	0.16706	0.00884

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
5.452694	4.641803	3.677879	3.511981	3.091168	3.076538	2.998551	1.602861

63

Table **VI**. 1988 Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
R1	-0.27505	0.89279	0.08632	0.20203	0.03807	-0.06616	0.00531	-0.04076	-0.12109
R2	-0.12198	0.49161	0.79186	0.02704	-0.04364	0.10219	0.00839	-0.09399	-0.04752
R3	-0.17015	0.76246	0.26647	0.12842	-0.02203	0.14304	0.01449	-0.17794	-0.03531
R4	-0.39921	0.85837	0.08828	0.18239	0.01502	0.11840	0.02086	-0.05620	-0.07013
R5	0.09030	0.34808	0.70721	-0.03352	-0.12055	0.16212	-0.34749	0.13402	0.34690
R6	0.21946	0.61896	0.11320	0.04194	-0.05975	0.20368	-0.35800	-0.01820	0.52415
R7	-0.10636	0.85533	-0.00005	0.15901	0.07781	0.19047	-0.18465	-0.00408	0.27030
R8	0.07927	0.03547	-0.10942	-0.08027	0.90393	0.06299	-0.29327	-0.05496	-0.03349
R9	-0.49623	-0.21638	-0.25158	0.09598	0.30022	0.05561	-0.32589	-0.31621	0.20231
R10	-0.00042	0.30632	-0.17396	0.40111	0.59311	-0.34631	0.23441	-0.12340	-0.27855
R11	-0.01430	-0.17004	0.94331	-0.00831	0.00279	0.15063	-0.02092	-0.02619	-0.05240
R12	0.00427	-0.28825	0.19690	0.31641	0.28007	0.52892	0.09021	-0.49647	-0.24179
R13	-0.13126	0.19547	0.09019	-0.06592	-0.07685	0.93399	-0.10368	-0.11618	0.05532
R14	-0.11625	0.00336	-0.28510	0.06772	-0.26341	-0.12970	0.85217	0.06262	0.17873
R15	-0.08217	-0.08885	0.14512	0.12362	-0.24722	-0.03652	0.89295	0.13553	0.06800
R16	-0.08320	-0.09932	0.01328	-0.12203	-0.10112	-0.13011	0.29782	-0.02978	0.81449
R17	-0.01596	-0.32384	-0.01226	-0.02753	-0.03974	-0.90248	0.09543	0.03382	0.09264
R18	0.90150	-0.17833	0.28695	0.00362	-0.03702	-0.08302	-0.06686	0.10256	0.01709
R19	0.94389	-0.09811	-0.07840	0.06968	0.08338	-0.02054	-0.05649	-0.03676	0.05933
R20	0.90821	-0.27575	-0.11449	0.01422	0.17607	0.01549	-0.06200	-0.01465	0.00437
R21	0.86399	-0.09486	0.38422	-0.08973	-0.16666	-0.12107	-0.01451	0.13451	-0.04920
R22	0.95651	-0.03178	-0.17196	-0.03186	-0.00422	-0.01266	-0.02978	-0.05198	0.00076
R23	0.93509	-0.08990	-0.19228	0.01346	0.17092	0.07523	-0.04535	-0.00425	-0.06917
R24	0.02148	0.47466	-0.29349	0.35528	0.52311	-0.32603	0.16009	0.19590	-0.26530
R25	0.09903	0.01707	-0.03436	-0.10092	0.90358	0.05089	-0.27745	0.20716	-0.01319
R26	0.00387	-0.22683	0.21275	0.02975	0.03688	-0.00299	-0.06520	0.89461	-0.04764
R27	-0.07231	0.03536	0.07524	-0.00993	-0.15558	0.16166	-0.36885	-0.75982	0.00413
R28	-0.01732	-0.05513	-0.72663	0.18972	0.28727	0.24326	-0.10286	-0.32447	-0.04847
R29	-0.11086	-0.66553	0.28781	-0.26107	-0.19957	-0.35672	-0.11469	-0.03132	0.24479
R30	0.06536	0.26754	0.21296	0.87455	-0.13254	-0.07666	0.10482	0.09549	-0.05593
R31	0.02009	0.17008	-0.19924	0.95265	0.01564	0.03624	0.03444	-0.07914	-0.01795
R32	-0.18006	0.57324	-0.17480	0.74719	0.05950	0.11943	0.02581	-0.03536	-0.06676

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
5.773348	5.294578	3.551622	2.922599	2.869588	2.675597	2.465713	2.080060	1.537735

Table VII. 1989 Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
R1	-0.06027	0.96442	0.18286	0.04180	-0.05047	-0.01513	0.03969	-0.02848	0.03583
R2	-0.10427	0.59857	0.02378	0.72995	-0.04773	0.15256	-0.00628	-0.09549	0.08866
R3	-0.34994	0.84041	0.00726	0.24185	-0.03826	0.16380	0.03401	-0.03942	0.09427
R4	-0.01479	0.93692	0.18782	0.05105	-0.03685	0.13567	0.02150	0.01544	0.04876
R5	0.22444	0.00345	-0.07695	0.52008	-0.11340	0.01774	0.73558	-0.18046	-0.08922
R6	0.24504	-0.07024	-0.05327	-0.14738	0.00327	0.12186	0.90646	-0.11223	0.13264
R7	0.30422	0.30438	0.14775	-0.19894	0.18101	0.17879	0.80020	-0.08305	0.09015
R8	0.10377	-0.06095	-0.01840	-0.11318	0.93420	0.06471	0.04285	-0.24315	0.05072
R9	0.06533	-0.06754	0.17671	-0.41406	0.13615	0.12775	-0.34568	-0.20586	0.27383
R10	0.05259	0.30891	0.53806	-0.17208	0.55811	-0.36435	-0.13087	0.15709	0.20498
R11	-0.02478	-0.07026	0.02907	0.93988	-0.03767	0.15202	-0.11446	-0.08782	0.05033
R12	-0.31252	-0.23760	0.31448	0.24978	0.21961	0.55308	-0.17191	0.11631	0.46745
R13	0.13121	0.17052	-0.13997	0.02801	-0.07598	0.93852	0.10065	-0.09983	0.10404
R14	0.07404	-0.00110	0.15041	-0.29586	-0.27989	-0.17080	-0.08868	0.84769	0.01194
R15	-0.00089	-0.04398	0.24327	0.22692	-0.25440	-0.06984	-0.14887	0.85018	-0.10729
R16	-0.34607	-0.04491	-0.65928	-0.08564	-0.14219	-0.04141	-0.13255	0.54825	0.10428
R17	-0.20613	-0.27606	0.01329	0.06372	-0.06553	-0.86267	-0.16308	0.15143	-0.09236
R18	0.95659	-0.08969	0.04938	0.20172	-0.02098	0.03798	0.02875	-0.01641	-0.00842
R19	0.97039	-0.15938	0.09958	-0.07248	0.02401	0.04495	0.02855	-0.00834	0.05528
R20	0.94353	0.04909	0.15123	-0.13941	0.19352	0.09931	0.05738	-0.03482	0.05573
R21	0.89675	-0.03629	-0.02102	0.33865	-0.08833	-0.02729	0.20756	0.00718	-0.04307
R22	0.94571	-0.13127	0.02745	-0.14642	0.01000	0.02813	0.18814	0.02258	0.05962
R23	0.86038	0.21588	0.14331	-0.21481	0.21847	0.11951	0.24219	-0.00788	0.03780
R24	0.02212	0.45640	0.44926	-0.36231	0.53377	-0.31894	-0.06789	-0.02419	-0.12480
R25	0.09961	-0.06678	-0.03364	-0.05397	0.92309	0.04233	0.02002	-0.25744	-0.15022
R26	-0.06129	-0.17547	0.01132	0.20473	-0.01891	0.00050	-0.11836	-0.18237	-0.89105
R27	0.06202	0.05300	-0.06292	0.02778	-0.14223	0.20213	0.01922	-0.25291	0.82625
R28	-0.07227	-0.15208	0.09425	-0.74981	0.22826	0.29176	0.02332	-0.09038	0.32785
R29	-0.31982	-0.57871	-0.31070	0.35718	-0.29050	-0.23170	-0.22064	-0.01924	-0.04954
R30	0.09646	0.26131	0.85955	0.27533	-0.12359	-0.11458	-0.01529	0.17461	-0.08362
R31	0.06444	0.09944	0.93121	-0.20826	0.00333	-0.00614	-0.04944	0.17959	0.04363
R32	0.18245	0.61154	0.70027	-0.19385	0.08017	0.07649	0.03224	0.10282	0.03783

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
5.999208	4.401967	3.522734	3.509350	2.888219	2.590262	2.486138	2.234168	2.079470

Table VIII. 1990 Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
R1	0.31929	-0.09916	0.91257	-0.02879	-0.08941	-0.09240	0.05096	-0.11921
R2	-0.02297	-0.17271	0.78276	0.01159	0.40715	0.29255	-0.15858	-0.11981
R3	0.04805	-0.07216	0.89980	0.05449	0.22729	-0.09017	0.07811	-0.05120
R4	0.31583	-0.09766	0.87970	-0.07159	-0.14420	-0.07054	0.03794	-0.23257
R5	-0.13919	-0.11522	-0.20130	0.05154	-0.33343	0.86049	0.08315	0.08231
R6	-0.05792	0.34690	-0.24844	0.13249	-0.62679	0.19294	0.44393	0.23554
R7	0.27361	0.43230	-0.00769	0.28513	-0.70879	0.12152	0.30271	-0.03997
R8	0.17197	0.28600	-0.01133	0.85187	-0.12377	-0.06127	-0.05075	0.02605
R9	0.21843	-0.07988	0.06320	0.29169	-0.00645	-0.33995	0.44286	-0.04737
R10	0.83368	0.15118	0.12872	0.15873	-0.00018	-0.16152	0.04250	0.29609
R11	-0.07167	-0.26666	0.15100	0.07467	0.56621	0.66990	-0.11046	-0.17054
R12	0.33926	0.12401	0.11174	0.06949	0.77334	-0.00824	0.26737	-0.15099
R13	-0.18727	0.10820	0.26144	-0.01500	0.13396	0.05698	0.06259	-0.88988
R14	0.29106	0.09317	-0.16444	-0.76064	-0.28671	-0.22436	0.01787	0.22399
R15	0.27312	-0.09413	0.08332	-0.77441	0.03783	0.06370	-0.29297	0.00466
R16	-0.59052	0.07579	0.14212	-0.29438	-0.05455	-0.03862	-0.09293	0.43968
R17	-0.03112	-0.22702	-0.18661	-0.09530	-0.06617	-0.05033	-0.02888	0.92756
R18	-0.07617	0.63408	-0.01438	0.00292	0.31001	0.48668	-0.38149	-0.07360
R19	0.02880	0.95088	-0.14641	0.09733	0.09266	-0.06404	0.02004	-0.03586
R20	0.18473	0.89596	-0.09447	0.29326	-0.04602	-0.06916	-0.02743	-0.13150
R21	-0.24380	0.40086	0.03168	-0.10192	0.04960	0.74144	-0.37564	-0.14918
R22	-0.08767	0.89108	-0.15706	0.01020	-0.26944	0.01198	0.15766	-0.03752
R23	0.25265	0.78571	0.06225	0.20288	-0.41875	0.00217	0.04793	-0.25039
R24	0.70899	0.21812	0.24600	0.32797	-0.15121	-0.30598	-0.14613	0.30299
R25	0.14314	0.21640	-0.05658	0.86014	-0.12458	-0.04231	-0.25083	-0.00544
R26	-0.15376	-0.20231	-0.04573	0.18758	0.12821	-0.02406	-0.82781	-0.09498
R27	-0.05424	-0.10324	0.04410	-0.01503	0.07849	-0.11487	0.80149	-0.24914
R28	0.23475	0.49698	-0.13825	0.13942	-0.04966	-0.46212	0.50999	0.15374
R29	-0.58922	-0.38249	-0.25015	-0.04440	0.40307	0.11910	0.00767	0.41325
R30	0.87694	-0.08494	0.20791	-0.24603	0.13241	0.14118	0.00470	-0.07178
R31	0.84483	0.09537	0.00009	-0.14562	0.18224	-0.24709	0.20084	0.12952
R32	0.82969	0.04976	0.37810	-0.13707	-0.12829	-0.16527	0.11986	-0.10983

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
5.033593	4.896284	3.740378	3.383067	2.945821	2.796411	2.756378	2.691289

66

Table IX. 1991 Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
R1	0.83452	-0.05689	0.07061	0.28316	-0.18041	0.13576	0.25474	-0.07884	-0.16463
R2	0.25857	0.02825	-0.08051	0.86696	-0.23064	0.13310	-0.03923	-0.14889	-0.06959
R3	0.52289	-0.07110	0.11486	0.56915	-0.16239	0.09787	0.41986	-0.05154	-0.16222
R4	0.85535	-0.04495	-0.01140	0.21442	-0.17695	0.30895	0.16233	-0.08930	-0.18675
R5	-0.10060	-0.07780	-0.26268	0.56504	0.20447	0.30593	-0.53186	-0.28901	-0.15125
R6	-0.07377	0.11085	-0.10453	-0.19143	0.92877	0.08384	0.05963	0.04771	-0.12010
R7	0.45561	0.25131	0.06880	-0.24426	0.70547	0.37550	-0.01948	-0.01722	0.04178
R8	0.14777	0.18992	0.90119	-0.08464	0.07337	0.03328	-0.03901	0.01183	0.04299
R9	0.31005	-0.06296	0.11587	-0.15368	-0.01154	0.25195	0.15545	0.65240	-0.21255
R10	0.74550	0.19876	0.29627	0.03345	0.19086	-0.31731	0.03887	0.17462	0.25594
R11	-0.03577	0.03809	-0.08006	0.87865	-0.23181	0.14378	-0.19001	-0.04172	0.03609
R12	0.22107	0.14943	0.17377	0.61352	0.25739	-0.02624	0.35534	0.36317	0.30174
R13	0.06191	0.14436	0.01112	0.21870	0.05297	0.92881	0.04402	0.06040	0.05850
R14	0.14181	-0.12559	-0.64538	-0.45968	0.35042	-0.23031	-0.12142	-0.01789	0.15889
R15	0.44903	-0.23623	-0.67084	-0.01757	0.10335	0.05075	-0.33528	-0.10193	0.19168
R16	0.06232	-0.15753	-0.02419	-0.03592	-0.10518	0.20048	-0.00513	-0.05022	0.83598
R17	-0.18571	-0.25820	-0.12784	-0.16123	-0.11583	-0.86063	-0.05961	-0.05378	-0.21593
R18	0.01721	0.92358	0.00187	0.26224	-0.09729	0.00301	-0.10540	0.07022	-0.03104
R19	0.08004	0.94865	0.11467	-0.03507	0.11820	0.05249	0.07006	0.16849	-0.02439
R20	0.09815	0.84737	0.38864	-0.05806	0.21370	0.07735	0.06546	0.12470	0.07483
R21	-0.09123	0.77618	-0.03407	0.37758	-0.20350	0.12693	-0.16236	-0.36002	-0.11065
R22	-0.07211	0.86401	0.17058	-0.19391	0.21875	0.14942	0.18405	-0.14489	-0.14949
R23	0.18178	0.73074	0.43883	-0.20510	0.25651	0.26295	0.09972	-0.14847	0.01831
R24	0.72840	0.16032	0.49655	-0.09153	0.24207	-0.26540	-0.07812	0.13009	0.13961
R25	0.08547	0.17583	0.89485	-0.08908	-0.00793	0.04611	-0.28356	0.01500	0.05145
R26	-0.18409	-0.06560	0.18534	0.01720	-0.30641	0.08051	-0.79216	0.13010	-0.04106
R27	-0.06196	-0.00791	-0.06607	-0.03341	-0.06237	0.24966	0.82340	0.24575	-0.04866
R28	0.06102	0.22602	0.20906	-0.27818	0.57203	-0.08514	0.44130	0.38145	-0.02018
R29	-0.68983	-0.33200	-0.16013	0.25120	-0.21642	-0.33623	-0.09583	0.13354	-0.29864
R30	0.82718	-0.08368	-0.27242	0.17208	-0.03932	0.07996	-0.15361	0.27768	0.09360
R31	0.57344	0.03695	-0.08646	0.00344	0.32843	-0.21999	0.10416	0.60466	0.20832
R32	0.88058	0.04281	-0.07508	-0.06150	0.17690	0.12093	-0.02043	0.34453	0.04594

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
5.885854	4.966262	3.572715	3.571583	2.789269	2.716025	2.597577	1.775540	1.360103

Table X. 1992 Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
R1	0.85292	-0.34321	0.20505	0.07067	-0.14357	-0.19069	0.06072	-0.11526
R2	0.21765	-0.18387	0.89626	0.06075	-0.07032	-0.08903	-0.14464	0.12192
R3	0.46290	-0.50197	0.41626	0.25272	0.00967	-0.32688	0.11023	0.24902
R4	0.84463	-0.30921	0.19759	0.04777	-0.23434	-0.18077	0.02055	-0.19099
R5	-0.12421	0.11498	0.80125	-0.04199	0.04467	0.14347	0.46354	-0.10188
R6	-0.03255	0.33696	-0.07732	0.00759	0.05965	-0.13258	0.89652	0.01988
R7	0.37188	0.42912	-0.14294	0.18984	-0.20179	-0.07820	0.71380	0.03496
R8	0.12731	0.27390	-0.15981	0.82346	-0.18009	0.12033	-0.13793	0.03247
R9	0.20948	-0.12636	-0.22412	0.10521	-0.38293	-0.19380	-0.23996	0.12857
R10	0.87040	0.24303	-0.15831	0.03142	-0.02418	0.00309	-0.13550	0.24738
R11	-0.05283	-0.08815	0.91018	0.01858	-0.11781	0.04994	-0.23646	0.17446
R12	0.17654	0.04945	0.23535	0.07116	-0.15207	-0.25547	-0.09934	0.83535
R13	0.11989	-0.04164	0.19039	0.25645	-0.87655	-0.13384	0.00420	0.05625
R14	0.06247	0.13517	-0.42657	-0.75240	0.21442	0.00200	-0.14220	-0.03197
R15	0.27218	-0.05310	0.00201	-0.80866	0.00417	0.17738	-0.30448	0.02277
R16	0.09599	-0.16951	-0.02228	-0.11835	-0.31837	0.37094	0.09998	0.43907
R17	-0.20262	-0.15235	-0.08325	-0.14269	0.92200	0.02769	-0.05181	-0.09277
R18	-0.05414	0.82287	0.42408	-0.02960	0.10243	-0.03001	0.04441	0.11519
R19	0.06137	0.92029	-0.08583	0.03877	-0.02649	-0.05843	0.21103	0.13047
R20	0.02077	0.86648	-0.18438	0.29169	-0.11354	0.01483	0.13046	0.24564
R21	-0.12404	0.69831	0.61831	-0.08994	0.11760	-0.01508	0.04666	-0.22629
R22	-0.06146	0.87391	-0.14320	0.02285	0.09269	-0.15415	0.22397	-0.17354
R23	0.21786	0.84135	-0.20007	0.27757	-0.17432	-0.04871	0.11357	-0.07316
R24	0.90556	0.07439	-0.19285	0.25625	0.08117	0.13180	-0.00272	0.11741
R25	0.08177	0.23033	-0.11253	0.81734	-0.13868	0.36567	-0.15397	-0.03800
R26	-0.18796	-0.22608	0.04448	0.18993	-0.01459	0.81325	-0.10215	-0.09581
R27	-0.06521	-0.05449	-0.07983	-0.06300	-0.41204	-0.79180	0.05476	0.07325
R28	0.05604	0.28974	-0.56374	0.18443	0.07052	-0.39098	0.25762	0.42258
R29	-0.64492	-0.44724	0.26065	0.05062	0.47074	-0.01507	-0.07313	0.05924
R30	0.86521	0.02805	0.24173	-0.28656	-0.09739	0.03390	0.00905	0.16401
R31	0.65223	0.23955	-0.18245	-0.23635	0.03908	0.02025	0.15325	0.55142
R32	0.93728	0.06270	-0.05368	-0.11371	-0.21124	-0.05342	0.04742	0.08523

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
6.263196	5.737369	4.138948	3.262386	2.664058	2.163369	2.090066	1.979148

Table XI. All Years (1983-1992) Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
R1	-0.01084	0.35191	0.88628	0.01834	0.06338	-0.02927	-0.07866	-0.08163	-0.07672
R2	-0.00109	-0.00073	0.65182	0.00295	0.02444	-0.05204	0.63376	-0.19637	0.03573
R3	0.05144	0.11117	0.87544	0.04383	-0.00119	-0.11172	0.19302	0.15841	-0.13385
R4	-0.05181	0.33547	0.86515	0.04784	0.00018	-0.24157	-0.02835	-0.02561	-0.01992
R5	0.07977	0.02872	0.04746	0.98445	0.07833	-0.03361	0.04909	-0.06511	-0.00959
R6	0.06954	0.05112	0.01818	0.98884	0.08034	-0.05527	-0.02433	0.05643	-0.02944
R7	0.05960	0.09140	0.02655	0.98436	0.09586	-0.05295	-0.02784	0.04032	-0.01192
R8	0.09297	0.18120	-0.07321	0.12212	0.87444	-0.02501	-0.09010	0.12795	-0.00394
R9	-0.24738	-0.08106	0.05719	-0.00372	0.10758	-0.02085	-0.05062	0.65643	0.09236
R10	-0.02119	0.88630	0.09089	0.00037	0.21202	0.16789	-0.03839	0.03267	0.06142
R11	-0.05354	-0.09750	0.11556	-0.01223	0.02320	-0.02687	0.87512	-0.30487	0.14753
R12	0.04504	0.43075	-0.11935	0.02003	-0.00122	-0.26240	0.62840	0.46360	-0.02710
R13	0.07697	-0.15257	0.12315	0.07028	0.02379	-0.92584	0.15488	0.15305	-0.01988
R14	-0.09432	0.13752	-0.22314	-0.07099	-0.76382	0.09328	-0.29748	0.09190	0.14373
R15	-0.12020	0.23244	-0.18401	-0.07224	-0.73285	0.05704	0.07979	-0.17043	0.30980
R16	-0.02570	0.03980	0.03768	-0.00260	-0.08284	-0.13356	0.00434	0.07346	0.18225
R17	-0.13044	-0.07881	-0.13568	-0.04894	-0.12014	0.95262	-0.01220	-0.01533	0.02310
R18	0.93431	-0.01865	0.02560	0.02591	0.02536	0.00125	0.14326	-0.15117	0.00900
R19	0.95325	0.05135	0.00092	0.06570	0.07194	-0.06245	-0.04726	0.10939	-0.08075
R20	0.93830	0.02429	-0.02196	0.04926	0.10374	0.00014	-0.02230	0.08748	0.01937
R21	0.86751	-0.07537	0.02796	0.01549	-0.02122	-0.00701	0.16784	-0.41535	-0.00756
R22	0.93919	0.01050	-0.02184	0.05628	0.04909	-0.09973	-0.13571	0.02438	-0.16242
R23	0.92806	0.08868	0.01784	0.04905	0.11842	-0.09450	-0.10908	-0.00378	-0.01696
R24	0.00903	0.57065	0.36283	-0.01964	0.24680	0.19751	-0.25840	0.11593	0.50107
R25	0.06271	0.11947	-0.13447	0.05593	0.86446	-0.01321	-0.04644	0.05736	0.26010
R26	-0.06127	-0.12552	-0.05829	-0.02877	0.05485	0.11811	0.03040	-0.09236	0.86811
R27	0.08036	-0.12554	0.33021	0.01066	0.05973	0.03253	-0.14472	0.12217	-0.60262
R28	0.15725	0.18697	-0.05960	0.04766	0.13447	-0.15874	-0.26138	0.77107	-0.29647
R29	-0.12808	-0.59150	-0.19194	-0.04405	-0.15943	0.51999	0.39218	0.19306	0.01878
R30	0.02437	0.84341	0.21090	0.02696	-0.19482	0.00663	0.18563	-0.22330	0.07829
R31	0.09222	0.88824	0.06228	0.08208	-0.11732	0.01116	0.05373	0.24559	-0.06959
R32	-0.02260	0.87104	0.29429	0.11165	0.00389	-0.18837	-0.07236	0.03569	-0.02659

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
5.365263	4.417036	3.331903	2.995360	2.934462	2.381119	2.178807	1.900078	1.781292

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